



# TAMPERE ECONOMIC WORKING PAPERS

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# The Elasticity of Formal Work in African Countries

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## Abstract

A key policy problem in most developing countries is the size of the informal sector and its persistence over time. At the same time, these countries also need to increase their tax take. However, this may slow down the formalization of the economy. Evidence on the wages and characteristics of jobs in different sectors and on the impact of tax changes on the size of the informal sector in developing countries is, however, very limited. This paper therefore estimates the tax responsiveness of the extensive margin of formality, i.e. the propensity to participate in formal work as opposed to working as an informal worker, for four Sub-Saharan African countries. Using repeated cross-sections of household data and applying grouping estimator techniques, this paper finds only very small or statistically insignificant effects of taxes on the extent of formal work.

**Key words:** developing countries, Sub-Saharan Africa, taxation, labour supply, informality

**JEL codes:** H31, J20, O17

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# 1 Introduction

In most developing countries the informal sector is substantial in size. A recent survey by Charmes (2012) provides comparable information about the size of the informal sector in different countries. According to his numbers, the share of the informal sector in non-agricultural employment was on average 58% in Latin America in 2005-10, whereas it was much larger in Sub-Saharan Africa (approximately around 66%). In addition to its large size, the informal economy shows no clear declining trend. In Sub-Saharan Africa, according to Charmes (2012), the informal employment share was around the same in 2005-10 as it was in the 1980s.

Almost by definition, the informal sector falls outside the tax base available to governments, who are under pressure, internally and from donors, to raise their tax revenues. Besides, domestic tax revenue mobilization is also one of the Sustainable Development Goals (SDGs). While countries in Africa have been able to increase their tax take since the early 2000s, (see Figure 1, which provides information about the tax revenue to GDP ratio for selected African countries and for Sub-Saharan Africa on average), one observes a large heterogeneity across countries and one can still argue that more revenues would be needed to be able to finance necessary developmental spending. Rising inequality is also a concern in Africa, and one way of reducing inequalities could be raising more taxes using progressive income taxes. However, currently African countries obtain generally very little tax revenues using direct taxes on labour income (Figure 2).

There may easily be a trade off between the two needs, the desire to generate more jobs within the formal sector and the goal of raising more revenues – perhaps especially using the labour income tax – which may create to disincentive to formalize. Productive enterprises of course may choose whether to operate in the formal or informal sector. It is highly likely that one of the most important margins of response of economic behavior to changes in tax and transfer policies in developing countries is the extent of formal work. Besley and Persson (2013) note that this elasticity is also a quantitatively important ingredient of the elasticity of taxable income, which is a sufficient statistic that determines the size of the distortions the tax system creates also in the presence of informality. The severity of these distortions can be weighed against the distributional gains that can be achieved by the tax system.<sup>1</sup>

How large is the potential trade off? To be able to answer this question, one would need to obtain credible information about the responsiveness of the share of the formal sector with respect to the labour income tax wedge. From the outset it

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<sup>1</sup>This approach has proven very valuable in modern empirical public finance, see Piketty and Saez (2013).

is however not even clear that an individual would necessarily prefer working in the formal sectors. While much of the traditional literature (e.g. Fields (1975)) suggests that formally employed people earn more and informal employment is an escape from unemployment while looking for formal employment, this view has recently been challenged by studies on evidence for voluntary informal employment (Henley et al. (2009); Bargain and Kwenda (2011); Maloney (1999); Maloney (2004) and Bruhn and McKenzie (2013) (see Bargain and Kwenda (2011) for a more detailed discussion)). Moreover, Badaoui et al. (2008) do not find evidence for a wage gap between the two sectors when controlling for other characteristics. Related to this question, Bargain and Kwenda (2010) pointed out that the nature of the informal employment (e.g informal self-employment or informal salaried work) has an impact on the formal/informal earnings gap and that this gap is also affected by the individual's position along the income distribution, but that the effect of these two aspects differs across countries. Hence, the sensitivity of the decision to work in the formal sector may additionally be moderated by the varying pay premium for formal sector work by country, type of work and income level. Recent quasi-experimental econometric work on this topic does exist, especially for Latin American countries. However, we are not aware of any studies on this matter for low or lower middle-income African countries, where the trade off could be even more severe than in Latin America. In Latin America, larger social protection systems are already in place, whereas similar programmes are being scaled up in African countries. Therefore, the needed increase in the tax rate to finance such programmes may well be greater in Africa. At the same time the different scale and type of available benefits for formal workers and different tax systems may affect the incentives of workers to formalize and thus the elasticity of formal work.

The purpose of this paper is, therefore, to provide new evidence of the elasticity of formal work using representative household data from four Sub-Saharan African countries.<sup>2</sup> Building on the approach developed by Blundell et al. (1998), the idea is to utilize a number of tax and benefit reforms that treat different groups of individuals differently. These provide a large amount of exogenous variation to the relative attractiveness of working in the formal sector, which is needed for reliable causal estimates of the impacts of fiscal policies on formality. To the best of our knowledge,

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<sup>2</sup>While recent work on the effectiveness of policies lowering the costs to formalize a business, targeted at informal businesses in developing countries by Bruhn and McKenzie (2014) in general and more specifically on Benin by Benhassine et al. (2018), has questioned the cost effectiveness of incentivizing informal business to formalized in the light of prospective tax revenues from these firms in the near future, our study only focuses on the sensitivity of the probability to formalize based on passively induced tax incentives to formalize.

this paper offers the first estimates of the impacts of taxes on formal sector work for African countries – with the exception of South Africa – that are based on a modern, credible, estimation strategy.<sup>3</sup> Given the very different state and nature of social benefits and tax systems in African countries than in South America, this study can provide important evidence from a different geographic areas and countries in a different stage of development, which can inform about the external validity of earlier results from South America. An additional important contribution of the paper is that we provide a considerable amount of descriptive material about the differences (with a special reference to their earnings) between formal and informal sector workers in Africa. Perhaps somewhat surprisingly, there is not much earlier empirical work on this matter.

The paper proceeds as follows. In the next Section, we provide a review of earlier relevant work, which, as was mentioned above, largely focuses on Latin America. Section 3 provides the theoretical background and the econometric strategy of the paper. Section 4 presents the data and some descriptive statistics. The results are presented in Section 5. Section 6 concludes.

## 2 Literature review

Starting more generally, formality status as such is a debated term. The literature has defined it in multiple ways, resulting in different levels of formality and different people being classified as either formal or informal, which do not necessarily overlap (Henley et al. 2009). While the terms informal sector and informal workers are often used interchangeably, the literature distinguishes, according to Henley et al. (2009), between three main alternative definitions of formality status: The first purely relies on a contract status whether a worker is formally or informally employed, the second is based on whether an individual contributes to social security and the third distinguishes between salaried employees in firms with more than five employees as being formal and self-employed or own account workers, who are not professionals, as being informal. If an individual is self-employed but contributes to social security, the person would, according to the first definition, be classified as informally

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<sup>3</sup>While high-quality data for South Africa would be available, we left South Africa outside of the sample because of the large institutional differences between South Africa and poorer Sub-Saharan African countries. In South Africa, unemployment is close to 30%, there are unemployment benefits, and the formal sector is fairly large, whereas in other African countries, unemployment rates are low, unemployment insurance benefits are largely inexistant, and people typically work in the informal sector partly due to lack of formal sector jobs. See Bhorat et al. (2014) and Tondini et al. (2017) for recent quasi-experimental evidence regarding the employment effects of wage costs in South Africa.

employed. According to the third definition, they would be working in the informal sector whereas according to the second definition they would be a formal worker. Hence, the definition of formality status matters and consistency in its definition over time and accross countries is highly important.

While there is an extensive literature comparing the characteristics of the formal and informal sector in developing countries, the literature looking at the impact of changes in taxes and transfers on choices of workers (or sometimes firms) to participate in the formal sector is much smaller. Some of this takes the form of calibration models, of which an important example is Albrecht et al. (2009). They look at the choices of workers to be in the formal sector, informal sector or to move between the two, and simulate what would be the effect of changes in payroll taxes and severance payments on the size of the informal sector. Not surprisingly an increase in the severance tax encourages workers to leave the formal sector and join the informal sector, and a reduction in payroll tax has the opposite effect. Other calibration models include those by Bosch and Esteban-Pretel (2013), who look at the effect of changes in taxes and transfers, especially unemployment insurance, on the size of the informal sector Alonso-Ortiz and Leal (2013), who use a calibration model to consider the responsiveness of informality to taxes and transfers in Mexico and Feltenstein and Shamloo (2013), who simulate the effect of tax reform in Russia on the size of the underground economy there.

In terms of empirical studies, the only study we are aware of for African countries is that of Auriol and Warlters (2012), who develop a simple general equilibrium model for 38 African countries. The paper does not contain estimates or quasi-experimental evidence about the impacts of the tax burden on the extent of formal work, but it rather provides a simulation analysis and calculates marginal cost of public funds for various tax instruments.

These issues have been studied in much greater detail in Latin America, and to a lesser extent in transition countries or in other parts of the world. Lora and Fajardo-González (2016) have examined the effects of payroll taxes, value-added taxes and corporate income taxes on a variety of labor market outcomes such as participation, employment, informality, and wages in 15 Latin American countries using macro-level panel data. The effects of each tax are markedly different and may depend on several aspects of labor and tax institutions. Payroll taxes reduce employment and increase labor costs when their benefits are not valued by workers, but they can also increase labor participation and lower labor costs. Value-added taxes increase informality and reduce skilled labor demand.

Many other studies have taken a micro approach. Kugler and Kugler (2009) using plant level data for Colombia find that a 10% increase in payroll taxes leads to reduc-

tion in formal employment of between 4 and 5%. Antón (2014), also for Colombia, finds that a fall in payroll taxes increased employment overall and formal employment in particular. Using a panel of administrative records of employees Morales and Medina (2017) estimate a significant increase in formal sector employment as a result of 13.5% reduction in the payroll taxes in Colombia. This finding is confirmed by Fernandez and Villar (2017) who estimate a 4.8% reduction in informality of the same reform using household survey data. Besides, Gorodnichenko et al. (2009) and Zarković-Rakić et al. (2016) looked at tax reforms on the size of the informal economy in Russia and Serbia respectively.

Other studies have considered the effect of transfers on participation in the formal sector. Bergolo and Cruces (2014b) look at the effect of a social insurance reform in Uruguay extending health care coverage to dependents of registered workers, and find that the reform increased those working in registered employment significantly. In another paper, also on Uruguay, Bergolo and Cruces (2014a) study the incentive effects of the social security program on labor supply using a regression discontinuity design. In particular, they examine in detail the anatomy of behavioral responses – responses along different margins and the heterogeneity within the outcomes. Their results indicate that a one percentage point increase in net income implies an about 1.7 percent increase in registered employment. Garganta and Gasparini (2015) have studied how the Universal Child Allowance (AUH) program, i.e. an income maintenance program in Argentina, affects the incentives of informal workers to transition to the formal sector labor market using a difference-in-differences strategy. The evidence suggests that while formalization (entry rate into registered jobs) of both groups (eligible and non-eligible) follows an almost identical path before the end of 2009, the patterns diverge significantly from that date, which coincides with the implementation of the AUH. They found that the program has a disincentivizing effect (in contrast, there is no evidence that registered employment becomes informal). These effects apply to self-employed workers, informal salaried employees and the unemployed, and are particularly strong for poor workers in large households and with children of young age.

Other studies on the subject include e.g. Bosch and Campos-Vazquez (2014). They estimate that the implementation of Mexico’s Popular Health Insurance program reduced the stock of registered employers by 3.8% and employees 2.4%. Alzúa et al. (2012) perform a random assignment to study the effect of welfare programs on work incentives and the adult labor supply in Mexico, Nicaragua and Honduras. The result is that the programs have not introduced any substantial disincentives to work and that they have had no significant effect on the intensive or the extensive margin of labor supply for individuals or households in treatment localities.

## 3 Theory and estimation

### 3.1 Conceptual framework

To fix ideas, this Section presents a highly stylized model of occupational choice, inspired by the literature on the extensive margin labour markets in public economics, for a recent example see Jacquet et al. (2013). Suppose that the individual can either work at the formal sector, earning income  $y_f$ , or at the informal sector (or in the shadow economy), earning income  $y_s$ . If the individual works in the formal sector, he or she pays taxes  $T(y_f)$  and obtains transfers equal to  $B(y_f)$ . Thus, net income in the state of formal work is given by  $x_f = y_f - T(y_f) + B(y_f)$ , which must be sufficient to finance consumption  $c_f(1 + t)$ , where  $t$  is the consumption tax rate. Note that payroll taxes affect the gross salary. The labour costs to the employer, denoted by  $Y_f$ , are  $Y_f = (1 + p)y_f$ , which means that the gross income already encompasses the effect of payroll taxes, as gross income can also be written as  $Y_f/1+p$ .

If the individual works in the informal sector, no taxes are paid, but the individual might still be entitled to some benefits,  $B(y_s)$ , reflecting the fact that social protection programmes in developing countries often reach those working outside of the formal sector. Net income in the state of informal work is thus  $x_s = y_s + B(y_s)$ , which is used for consumption  $c_s(1 + t)$ . Note that here we assume that both, those in the formal sector and those in the informal sector pay indirectly the value added tax. Those who do not work at all can be treated as informal sector workers, but earning just zero labour income.

The individual utility is linear (or log linear) in consumption, and utility when working in the formal sector is thus  $x_f/(1 + t) - \psi$ , where  $\psi$  is the cost (which can be negative) of working at the formal sector. The costs are positive if working at the formal sector requires e.g. a longer commute but the costs can also be negative, if formal sector work also brings about other benefits (such as retirement income). The utility when working at the informal sector is just  $x_s/(1 + t)$ . This means that the individual works at the formal sector if

$$x_f - x_s \geq \psi(1 + t), \tag{1}$$

which also means that the commodity tax does not affect the choice between formal vs. informal sector work.



### 3.2 Estimation

For linear probability models, the empirical counterpart of equation 1, the probability to work at the formal sector  $P(y_f > 0)_{i,t}$  for the individual  $i$  and at period  $t$  is<sup>4</sup>

$$P(y_f > 0)_{it} = \alpha + \beta \times [x_f - x_s]_{it} + \epsilon_{it}, \quad (2)$$

where  $P(y_f > 0)$  is defined to take on the value of 1 if the individual supplies earnings at the formal sector exceeding zero.<sup>5</sup> The extensive margin formality elasticity, i.e. the percentage change in the probability to work in the formal sector with respect to a percentage change in the take-home pay difference between formal and informal work, can be calculated as  $\beta \times [(x_f - x_s)/P(y_f > 0)]$ . Note that the estimation of the probability to work in the formal sector does not only hinge on tax and benefit reforms, but it is also identified from shocks affecting the gross pay in the two different states.

Estimating the equation above poses a number of challenges. First, the right-hand side regressor is correlated with  $\epsilon$  and so endogenous. The most obvious reason is that both taxes and benefits are direct functions of income. An additional reason is that unobserved variables (e.g., tastes for work and savings) might affect the choice of working at the formal sector. And clearly, the individual is only observed in at most one state at a given time, so income in the other state needs to be imputed.

Our approach to tackle these issues is to utilize the repeated cross section element of the data. This allows us to compare *groups* of individuals over time and, thereby, address these endogeneity issues by constructing instruments. Following Blundell et al. (1998), we partition the sample into group cells based on country, gender, age and education level. The key idea behind the grouping procedure is to compare otherwise similar groups of individuals who have been affected differently by tax reforms (the difference-in-difference setting), while retaining the ambition to estimate structurally meaningful parameters, in this case the formality elasticity.

Let  $g$  denote group cell. Suppose that  $\epsilon_{it} = \alpha_g + \mu_t + \eta_{it}$ , where  $E[\eta_{it}|h_{it} > 0, g, t] = 0$ . According to this assumption unobserved heterogeneity, conditional on  $g$  and  $t$ , can be captured by a permanent group effect  $\alpha_g$  and a time fixed effect  $\mu_t$ . This assumption can also be modified in such a way that it allows e.g. for education-group-specific linear time trends. Let  $\omega_{gt}$  be a vector that contains the full set of interactions between group and time. By assumption, these are uncorrelated with  $\eta_{it}$ . This is the central exclusion restriction for identification. We can then estimate

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<sup>4</sup>Formally, this derivation assumes that  $v(y)$  is uniformly distributed. Ideally, one would perhaps want to assume a normal distribution and, hence, arrive at a probit model. This would lead to the so-called incidental parameters problem, rendering the empirical estimations unfeasible.

<sup>5</sup>The discussion in this section draws on Jäntti et al. (2015).

$$P(y_f > 0)_{it} = \alpha + \beta \times [x_f - x_s]_{it} + \alpha_g + \mu_t + \eta_{it}, \quad (3)$$

by two-stage least squares (2SLS) while using  $\omega_{gt}$  as excluded instruments for  $(x_f - x_s)$ . Crucially, both the order condition and the rank condition for identification need to hold. The order condition requires us to have at least as many instruments as endogenous regressors (in our case, one). The rank condition requires that net income must change at different rates for different groups over time. As the variation in the second-stage equation is entirely at the group level, equation 3 can also be estimated by collapsing the data into time-specific group averages of the relevant variables.<sup>6</sup> We then estimate the parameters from

$$\overline{P(y_f > 0)}_{gt} = \alpha + \beta_{ext} \times \overline{(x_f - x_s)}_{gt} + \alpha_g + \mu_t + \eta_{it}, \quad (4)$$

by GLS, using group size as weights. Using either equation 3 or 4 yields identical results.

To deal with missing income in either of the states, we proceed using a simple and transparent approach utilising cell means. For single households (with or without children) we use the cell means  $\overline{y_f - T(y_f) + B(y_f)}$  and  $\overline{y_s + B(y_s)}$  to get estimates for the net income in the states of formal work and informal work, respectively. We average over individuals with and without formal earnings, respectively. Cells are, as in the main specification of the regression analysis, constructed using survey wave, sex, educational category, and age group. Likewise, the cell mean labour income for those whose earnings are strictly positive is used to get an estimate of the expected income for the individual when working.

Our main approach is to utilize regression equation of the form (4), since each individual is observed in only one state, and the wage in the counterfactual state would need to be imputed also in individual level regressions. However, imputing incomes allows one to run the 2SLS estimates, which can be utilized to test the predictive power of the group\*time interaction instruments in the first stage.

Finally, grouping estimators have been shown to be sensitive to small-sample bias (Deaton, 1985). For this reason, we limit the cell size to a minimum of 10 in the analysis below and a minimum of 25 in robustness checks.

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<sup>6</sup>See Angrist and Pischke (2009) for an interesting discussion about IV estimation on grouped data.

## 4 Data and descriptive information

This section first discusses the data used for this analysis and thereafter presents some descriptive statistics. This study is based on labour force survey data or labour force modules of living standard household surveys from four Sub-Saharan African countries: Ghana<sup>7</sup>, Rwanda<sup>8</sup>, Tanzania<sup>9</sup> and Uganda<sup>10</sup> over a time period from 1991-2014. The choice of countries is geographically limited to countries in sub-Saharan Africa. Furthermore, it is based on the size of the economy in terms of GDP, the availability of at least two recent waves of a nationally representative survey with individual income data<sup>11</sup>, information regarding the individuals' demographic characteristics and either direct or indirect information concerning the individual's formality status.<sup>12</sup> Nevertheless, the number of observations, presented in the last row of Table 1 and Tables A.1-A.4, shows large variation and fluctuations of sample sizes across countries and waves, whereby, based on the sample sizes findings from Ghana may be most robust.

Besides, this study draws on minimum wage, tax rate and tax bracket information obtained from the local tax authorities' and big four accounting firms. Annual income data<sup>13</sup> is inflation adjusted<sup>14</sup><sup>15</sup> and rebased to the last wave's survey year for each country. Income levels above the 99th percentile of the distribution are considered outliers and replaced by the cut-off value. Only individuals working and reporting strictly positive cash income are included, whereas in-kind income is not taken into

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<sup>7</sup>Ghana: Ghana Living Standards Survey (GLSS) 3 (1991), GLSS 4 (1998), GLSS 5 (2006) and GLSS 6 (2012)

<sup>8</sup>Rwanda: Enquête Intégrale sur les Conditions de Vie des ménages (EICV, in English: Integrated Household Living Conditions Survey) 1 (2000/2001), EICV 2 (2005/2006), EICV 3 (2010/2011)

<sup>9</sup>Tanzania: Integrated Labour Force Survey (ILFS) (2005/2006), ILFS (2014)

<sup>10</sup>Uganda: Uganda National Panel Survey (NPL) (2009/2010), NPL (2010/2011), NPL (2011/2012), NPL (2013/2014)

<sup>11</sup>Given the debate in the literature concerning the reliability of income data in developing country surveys and often used alternative is consumption data. This study focuses on surveys with income data to avoid bias from mixing income and consumption data.

<sup>12</sup>We excluded countries with periods of major conflict around the time of the survey.

<sup>13</sup>Income is reported in different frequencies (e.g. daily, weekly, monthly) and scaled to the annual level, irrespective of the actual tenure and annual income of the job. For surveys with income questions for the past 12 months and the past 7 days, the most recent information is considered leading and complemented when missing with the information from the past 12 months to minimize the recall bias as well as missing information in the income data

<sup>14</sup>Income is inflation adjusted at the annual level, assuming that incomes are also not adjusted at higher frequency for inflation.

<sup>15</sup>Using instead hourly wage, would introduce too much noise in the data.

consideration. Unless in salaried employment, agricultural income is excluded from the analysis as this is assumed to be largely coming from informal subsistence farming and data on agricultural revenues and costs is relatively noisy. Moreover, those working in the public sector, which represent between 4%-22%<sup>16</sup> of all non-subsistence agricultural workers, are excluded. Public sector workers are by assumption formal workers and are assumed to have a lower incentive to change their job in order to change their formality status as the tax wedge does not necessarily have the same importance for the public sector. Quasi-public sector workers consisting of mainly state owned enterprise employees are however included. While many individuals may engage in more than one job, this study only considers the income from the main job, if indicated as such and otherwise the income from the job with the highest salary<sup>17</sup>.

Following Henley et al. (2009), who suggests that in the absence of information regarding formality status based on contracts, one should use information concerning social security contributions as the prime alternative, we use social security contributions as the main indicator for formality and subsequently use the terms (in)formal sector, (in)formal workers and informally employed interchangeably. Additionally, those people receiving medical care and retirement benefits from their employer are considered formal, as well as those, who claim that their employers withhold taxes from their income. Besides, those who claim to have a formal private sector job and for whom the preceding information is missing are considered formal. All remaining are classified as informal, under the assumption that those individuals, who are formal would have answered to be identified as such through any of the preceding questions. As Figure (3) shows, of the individuals working in the non-public and non-subsistence agriculture sector around 20% are formal with no clear trend over time in any country.

Identifying formality status allows the calculation of a net real annual wage for the formal and informal sector. For all those, who report that net income has already been deducted, the reported income is considered the net income. In other formal sector cases, the reported wage is adjusted by the appropriate tax rate.

To test for heterogeneity in descriptive outcomes and to be able control for demographic characteristics when estimating the elasticity of formal work, this study further restricts the sample to only those observations for which information regarding age, gender, region, relationship to household head, marital status and occupation exist. These are characteristics previously shown to moderate the probability to

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<sup>16</sup>Ghana 14%, Rwanda 4%, Tanzania 9% and Uganda 22%

<sup>17</sup>Income data from Tanzania ILFS 2006 does not distinguish between main and secondary job income. In this case, the sum of income from both main and secondary job is therefore used in both waves, but the formality status of the main job.

work in the formal sector.<sup>18</sup> Individuals are furthermore grouped according to educational achievement and different parts of the analysis use each two different levels of aggregation of educational categories. For the descriptive analysis one measure distinguishes between four categories of completed educational levels (no or less than primary education, primary education, junior secondary education, senior secondary and above), whereas the second splits the last category into senior secondary and post-secondary/tertiary education, thus consisting of five categories. For the regression analysis the first two categories (less than primary and primary) are combined. As respondents have no incentive to not report their educational level and are likely remembering the achievement of a particular level if completed, individuals, who do not report their education level are assumed to have no or less than primary education. Further, the analysis restricts itself to five age groups between 15 and 60 years, considering the compulsory education, legal minimum working and retirement age, but uses open ended age ranges for robustness checks.

Summary statistics, presented in Table 1, show the aggregated distribution of individuals across sectors, occupations, age groups and other demographic characteristics, as well as how these individuals divide over the formal and informal sector. In all countries the quasi-public sector consisting of state-owned enterprises, NGOs and international organizations, represents at most 6% of employment and is thus a rather small sector. Around 70% of individuals gain their main income from self-employment or working in their family business and around 30% through private sector salaries employment. Only in Uganda the latter two shares are slightly more balanced. In terms of occupations, the large majority of people hold sales and shop worker and elementary jobs and in Ghana and Tanzania also craft and in Rwanda clerical jobs. As Tables A.1-A.4 show, these patterns are in each country consistent over time.

For all countries, men, household heads and middle aged individuals (25-44 years) are more likely to be formal workers. Moreover, the share of individuals working in the formal sector rises with education. Professionals and Technicians and Associate Professionals are occupations most likely to be formal whereas Clerks and Sales and Shop workers are most likely informal. Probit model estimations on the determinants of the formality status, presented in Table A.10 in the Appendix confirm these aggregate findings and further suggest that men, household heads, women, employees and those living in urban areas are more likely to have a formal job. In addition, having kids increases in all countries but Ghana the likelihood of being a formal worker.

Whereas the distribution of characteristics across individuals and the distribution

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<sup>18</sup>That these factors matter also in our case can be seen from the results of probit regressions on the determinants of informality in Table A.10 in the Appendix.

of formality status have, as Tables A.1-A.4 show, been rather stable across waves, the annual net mean income in the formal sector is not in all waves larger than the mean income in the informal sector, as it is the case for the aggregate. According the GLSS 3 survey in Ghana and the IFLS 2006 survey in Tanzania, informal workers earn in aggregate terms more than formal workers.

Density plots of aggregate formal net income and informal income show very little difference in mean income (Figure 4). Neither do density plots by gender (Figure A.1). In terms of shape of the distributions in Figure 4 one observes mainly two distinct patterns. The first is especially visible for Uganda and the later waves for Ghana in which the distribution largely overlaps with the exception of a much longer tail of low informal incomes. The second contains distributions with similar means but a larger variance of informal incomes, as clearly visible in the tighter distribution of formal income around its mean in the case of Tanzania and the first round of Ghana. A decomposition of mean annual income by urban/rural status, employment type, or occupation in Table 2 shows that in aggregate terms the formal sector incomes are generally higher, but there are some exceptions where the reverse holds and there is a lot of heterogeneity between the specific groups without a clear pattern across countries of which sector pays more in a particular subgroup. This finding links to the debate in the literature<sup>19</sup> regarding the direction of the pay gap between these two sectors and is in line with findings by Badaoui et al. (2008) from South Africa, suggesting that the formal sector wage premium disappears when comparing net formal wage with informal wages. The fact that we find higher informal than formal mean wages for some sub-group samples, such as Ghana 1991 and Tanzania 2006 and potentially when disaggregating by gender as in Figure A.1, is not all too surprising and supported by recent findings from Brazil. These show that for the first quarter of 2014 the mean informal income exceeded formal income for women aged 25-55 Matos and Portela Souza (2016). This is further supported by findings that controlling for other characteristics. Matos and Portela Souza (2016) observe an overall significant reduction in the wage premium of working in the formal sector between 2002 and 2014 from about 10%(9%) to only 5%(3%) for men and women, respectively. Based on previous research's findings one should not necessarily expect a net pay premium in the formal sector nor an increase in the premium over time as a country develops. Therefore, the observed distributions do not challenge previous evidence.

Figure A2 provides information about the actual tax rate variation that formal sector workers have encountered. For this chart, wages from earlier rounds have been

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<sup>19</sup>For more references on this debate see Badaoui et al. (2008).

uprated into the latest survey year level using an index based on mean wage growth. The graph shows that, for the case of Ghana, there is quite substantial variation in the average tax rate in the cell-level data across the income distribution. Since there has been little variation in the marginal tax rates, these changes mainly occur due to “bracket creep” (or fiscal drag), i.e. that tax schedules have not been adjusted in a one-to-one relation with wage growth.

## 5 Results

### Main Results

Table 3 presents the elasticity of formal work for each country, based on the regression results using the grouped estimator and the two variations of educational categories, discussed in section 3. The first column shows the cross-sectional correlation, whereas the second includes the full set of indicator variables. The results for Ghana and Uganda suggest that the elasticity would be close to zero. This means that there is no robust evidence that a rise in the net wage difference between formal and informal sector, through tax cuts, leads to rise in the share of formal workers, as theory and findings by Fernandez and Villar (2017), Kugler et al. (2017) and Morales and Medina (2017) for a tax cut in Colombia suggest. More in line with the theory, in Tanzania the mean probability to formalize rises by nearly 0.5% when the wage premium of working the formal sector increases by 1%. However, this relationship becomes statistically insignificant when controlling for other characteristics and time. Hence, this may be a result of heterogeneous sensitivity of various demographic groups. In Rwanda on the other hand, the results provide limited evidence for the opposite relationship. In aggregate terms and when considering the detailed educational categories the probability to formalize decreases when the income difference rises, but when controlling for other characteristics and using more aggregate educational categories the probability to formalize increases with an increasing pay premium. All results are, as Table A.4 in the Appendix displays, while not in levels but nevertheless in terms of significance robust to using either aggregated or disaggregated educational categories in an open ended age range and restricting the age further to only those above 25 years.<sup>20</sup> The results are moreover robust to increasing the minimum cell size per group from 10 to at least 25 observations.

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<sup>20</sup>At age 25 the majority of individuals is assumed to have finalized their formal education. This avoids bias from a certain highly educated group of individuals more likely to be formal not being accounted for.

## Heterogeneity Tests

Given the gender difference in the observed aggregate wage premium for working in the formal versus informal sector, observed in the literature by Matos and Portela Souza (2016) for Brazil and visible in varying sectoral density plots of income by gender in Figure A.1, as well as gender being, as Table A.X shows, a significant factor determining informality, there is reason to expect that the

elasticity to work in the formal sector could also vary by gender. Moreover, restricting the sample to those individuals earning an above minimum wage reduces potential biases from extremely low informal wages. The estimations, presented in Table 4, restrict the model to those individuals earning more than the minimum wage, whereby columns (2) and (3) further restrict the model to only male and female observations, respectively. These findings largely resemble those in Table 1. Columns (3) in panel b) of Table 3, however, provide evidence for a positive significant elasticity of formal work for Rwandan women. This result is in line with findings by Kugler et al. (2017), who similarly find in Colombia a larger significant probability to formalize for women than for men at the lower income end. At the same time panel c) of the same table provides some evidence for a negative elasticity of formal work for male Tanzanians. However, these results are only indicative. Not only the number of grouped observations<sup>21</sup> are smaller due to an insufficient number of observations falling into a particular group<sup>22</sup>, but also the within group cell size is smaller and thus less representative. This is particularly the case when splitting the sample into half, when distinguishing between varying elasticities for men and women.

In addition to these, several alternative specifications are estimated: Firstly, the same model and its variations is estimated restricting the sample only to individuals working as salaried employees in the private or quasi-public sector. A second alternative aggregates the intermediate age groups and occupation types and additionally groups by urban/rural status and uses the more aggregated educational categorization. Whereas this introduces more variation in terms of group observations the cell size of each group is even smaller. To increase cell size, the third alternative does not group by educational category. Therefore the third alternative follows the second alternative specification, but does not group by educational category and instead adds controls for the share of married individuals, household heads and individuals with kids in each respective group. The results of these three alternative specifications

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<sup>21</sup>If there were sufficient observations for each group the group N for Ghana in the disaggregated educational category case and age 15-60 model should, for instance, be 4 survey waves\*2 gender\*5 age groups\*4 educational categories=160 groups and thus 80 groups for men and 80 for women.

<sup>22</sup>It is less likely to reach the minimum cell size of 10 observations.



are largely consistent with those of the main model and do not alter the previous results in terms of significance levels (see Tables A.7-9).

Apart from the grouped estimations, we also estimate individual level regressions based on imputed income as discussed in the last paragraph of section 2 (Methodology). In this way we can obtain an F-statistics for the excluded elements presented in Table 5. While the F-statistic for Ghana and Rwanda is much lower, than in the other countries, this is not of concern as the p-values for all these are very close to zero and thus highly significant. The low F-statistic may rather be a result of the larger number of interactions. There is thus significant evidence for the validity of the group\*time interactions as instruments in the first stage.

## Overall Discussion and Limitations

Taken together the findings suggest that changes in the formal – informal wage gap have no significant effect on the probability to be a formal worker for the population as a whole. There are however some exceptions: When controlling for other characteristics the probability for Rwandan women to work formally rise, whereas this probability decreases for Tanzanian men. The significant results for particular demographic groups suggest that country-specific tax and benefit systems might play an important role in incentivizing different demographic groups to formalize. No robust positive significant evidence and the absence of robust negative significant evidence for all other cases means that changes in the tax rate and resulting changes in the sectoral wage differential do not significantly change the probability to have a formal job. This result is supported by the density plots, presented in the section on Data and Descriptive statistics, which display largely overlapping distributions and only very minor differences between the locations of the mean of the distributions. While tax treatment of individuals had variation, it mainly stemmed from bracket creep, which workers may not necessarily notice. Moreover, some tax rate changes, especially in Ghana and Uganda, occurred mostly at tax bracket kinks that far exceed the income of the mean respondent, as the vertical lines in Figure 4 indicate <sup>23</sup>

Besides, the lack of sensitivity may be a result of a lack of advantages or little awareness concerning the advantages of a formal job apart from potentially a minimal wage premium. This would be in line with findings by Bargain and Kwenda (2011) that the formal sector wage premium is higher in South Africa due to larger legal benefits of a formal job than in Mexico and Brazil with fewer benefits from formal

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<sup>23</sup>For Ghana and Uganda the green vertical lines indicating tax bracket kinks with tax rate changes lie at the right tail of the income distribution and therefore only affect a very small proportion of the respondents.

jobs.

Besides, the findings might be attributed to a lack of knowledge and capacity, related to low levels of education, on how to formalize or imagined or actual bureaucratic costs of formalizing not outweighing the minimal pay differential. This view is, however, challenged by McKenzie and Sakho (2010)'s findings from Bolivia, where among large firms it is mainly high-ability entrepreneurs who stay informal and formalizing is not beneficial in terms of firm profits over all firm sizes. Alternatively, land ownership issues have been found to be important hindrances to formalizing business even when building capacity and eliminating formalization costs, as in the field experiment by De Mel et al. (2013) in Sri Lanka. These issues may also play a role in African countries. Apart from these potential explanations for our findings, there are several aspects directly related to the study design that should be considered when interpreting the results. The number of survey waves and the time frame they span varies across countries. This is especially a concern for countries, such as Tanzania, with just two survey waves and Uganda with four survey waves but conducted in consecutive years. Also survey sample sizes vary by country and survey wave and sample sizes (i.e. at least 10 observations per group cell, or 25 in robustness checks, with no formal/ informal proportional requirement within the at least 10 (25) observations per group cells) may not be large enough to capture the mean wage premium of working in the formal sector of the respective group. Finally, as stated earlier, income data in developing countries is very noisy<sup>24</sup>. Hence, this will make it by default difficult to find robust evidence for minimal changes in the formality rate. Nevertheless, this study gives some first and currently best possible indicative cross-country evidence on the relative (in)elasticity of formal work in sub-Saharan Africa.

## 6 Conclusion

In need of raising domestic revenues, developing countries are challenged by partly missing the underlying precondition to collect taxes, namely the existence of a tax base, due to the persistently large informal sector. A key policy question is therefore the elasticity of formal work, meaning to what extent increases in the tax rate incentivise people to move from a formal job into informal employment to avoid the tax burden, or a decrease in the tax rate may make working in a formal job

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<sup>24</sup>For this reasons many studies and surveys in particular in Africa with large shares of the population living on subsistence farming, use household budget questions, consumption or expenditure to proxy for income

more attractive and induce informal workers to formalize. While there is evidence for an effect of tax rate changes on intensive margin labour supply for developed countries and there is some evidence from Latin America that tax reductions may increase the incentives for individuals to work in the formal sector, evidence from developing countries in other parts of the world, in particular from African countries, characterized by an even larger informal sector, is still missing. Individuals in African countries may however react very different to tax rate changes, due to their less developed benefit and tax systems. This paper therefore sought to investigate this question for four countries in sub-Saharan Africa: Ghana, Rwanda, Tanzania and Uganda. Household survey data over a period from 1999 until 2014 is used to construct pseudo panels, consisting of two to four survey waves for each country. By applying grouping estimator techniques, this study subsequently estimates the effect of an exogenously induced change in the mean wage difference between the formal and informal sector, on the probability to work in the formal sector..

The focus is thereby on private and quasi-public sector worker for whom the choice to become (in)formal may be an option. Public sector workers and subsistence agricultural workers are excluded from the analysis, as these are by default considered formal and informal, respectively. For all other workers formality is determined based on tax payments and, if unavailable, based on social security contributions or benefits in terms of health care and pension plans or otherwise individual's self-reported formality status, which comes close to one of the, according to Henley et al. (2009), three main classification strategies identified in the literature. Other often used strategies to define formality have been the contract status or the sector of employment, distinguishing between salaried and self-employed workers. Information on the former is not available for all countries and the latter is considered not sufficiently comprehensive given the large share of non-tax paying salaried private sector workers.

In investigating the question of the tax rate sensitivity of formal work, this study faces a significant challenge concerning the quality of the available data on household incomes. However, even if imprecise, results based on these data give the currently the best possible estimates, as this is the only available data. Descriptive analysis shows a significant overlap between earnings in the non-public formal and informal sector, though with greater heterogeneity in the latter in almost all cases. The regression analysis, based on the expected differential between earnings in formal and informal work, shows no impact of this differential on the probability of being a formal worker.

While this issue still requires further research, different explanations for the finding of largely non-elastic formality status can be considered. The low wage differential

between the formal and informal sector in all four countries is likely to be a major factor. In addition, there is likely to be a limited availability of formal sector jobs, and especially so for those living in rural areas and those without or only low educational qualifications. Besides, workers currently in the informal sector, who might have the skills needed for formal jobs, may not be well informed about such vacancies and advantages of formal sector jobs. Moreover, there might be a general lack of information regarding the functioning of the tax system, tax rate changes and how to formalize in practice, which is relevant for the self-employed. Considering that the likelihood to work informally showed to be higher for those with lower education, there may be a general lack of capacity to formalize. Workers may also have, irrespective of the wage differential between the two sectors, other reasons for preferring to work in the informal sector, such as the proximity or flexibility of the informal job, or the perceived benefits of the formal sector not outweighing the perceived costs of paying taxes and the bureaucracy involved in formalizing. Furthermore, the country-specific design of the taxation system could have important effects on the elasticity of formal work due to differing incentives to formalize as a result of varying benefits that can be obtained from formalizing in different countries by different demographic groups. Lastly, the tax rate changes during the sample period and the bracket creep, caused by inflation adjusted wages falling into different tax brackets, may not have resulted in sufficient variation in the sectoral wage gap to initiate notable response

While there are obviously reasons to be cautious in interpreting the results, as income data in least developed countries is widely known to be noisy, the evidence this study gathered, which is robust to a variety of specifications, is not consistent with the notion of the existence of a severe trade off between the share of formal work and taxation. This study adds to the literature in terms of external validity regarding tax induced extensive margin labour supply decisions in developing countries.

The findings of this study have two important policy implications: First, it may be that raising tax rates mildly does not necessarily lead to a greater share of the informal sector. Second, the findings relate to Chetty et al. (2009)'s argument that in order to observe behavioural sensitivity to policy changes, such as changes in the tax rate, those policies need to be salient. Capacity building and information dissemination campaigns, targeted especially at the lower educated, rural population, and women, on the benefits of formal work, the practicalities of how to formalize and the working of the tax system, and addressing potential hindrances, such as land titles, may be policy tools that could help making the issue salient and result in enlarging the tax base in terms of individuals.

## References

- Albrecht, J., Navarro, L., and Vroman, S. (2009). The effects of labour market policies in an economy with an informal sector. *The Economic Journal*, 119(539):1105–1129.
- Alonso-Ortiz, J. and Leal, J. (2013). The elasticity of informality to taxes and transfers. Working Paper 13-08, Centro de Investigación Económica, ITAM, Mexico City, Mexico.
- Alzúa, M. L., Cruces, G., and Ripani, L. (2012). Welfare programs and labor supply in developing countries: experimental evidence from Latin America. *Journal of Population Economics*, 26(4):1255–1284.
- Angrist, J. and Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist’s Companion*. Princeton University Press.
- Antón, A. (2014). The effect of payroll taxes on employment and wages under high labor informality. *IZA Journal of Labor & Development*, 3(1).
- Auriol, E. and Warlters, M. (2012). The marginal cost of public funds and tax reform in Africa. *Journal of Development Economics*, 97(1):58 – 72.
- Badaoui, E. E., Strobl, E., and Walsh, F. (2008). Is there an informal employment wage penalty? evidence from South Africa. *Economic Development and Cultural Change*, 56(3):683–710.
- Bargain, O. and Kwenda, P. (2010). Is informality bad? evidence from brazil, mexico and south africa. *IZA Discussion Paper Series, IZA DP No. 4711*.
- Bargain, O. and Kwenda, P. (2011). Earnings structures, informal employment, and self-employment: New evidence from Brazil, Mexico, and South Africa. *Review of Income and Wealth*, 57:S100–S122.
- Benhassine, N., McKenzie, D., Pouliquen, V., and Santini, M. (2018). Does inducing informal firms to formalize make sense? experimental evidence from benin. *Journal of Public Economics*, 157:1–14.
- Bergolo, M. and Cruces, G. (2014a). The anatomy of behavioral responses to social assistance when informal employment is high. Discussion Paper 8198, IZA.

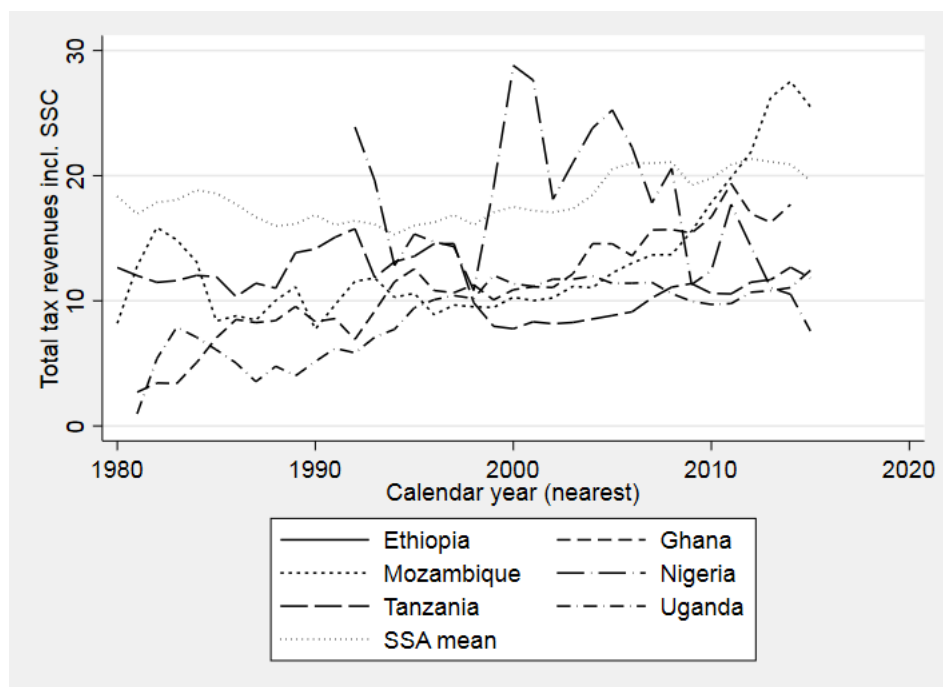
- Bergolo, M. and Cruces, G. (2014b). Work and tax evasion incentive effects of social insurance programs: Evidence from an employment-based benefit extension. *Journal of Public Economics*, 117:211 – 228.
- Besley, T. and Persson, T. (2013). Chapter 2 - taxation and development. In Auerbach, A. J., Chetty, R., Feldstein, M., and Saez, E., editors, *Handbook of Public Economics*, vol. 5, volume 5 of *Handbook of Public Economics*, pages 51 – 110. Elsevier.
- Bhorat, H., Kanbur, R., and Stanwix, B. (2014). Estimating the impact of minimum wages on employment, wages, and non-wage benefits: The case of agriculture in south africa. *American Journal of Agricultural Economics*, 96(5):1402–1419.
- Blundell, R., Duncan, A., and Meghir, C. (1998). Estimating labor supply responses using tax reforms. *Econometrica*, 66(4):827–861.
- Bosch, M. and Campos-Vazquez, R. M. (2014). The trade-offs of welfare policies in labor markets with informal jobs: The case of the "Seguro Popular" program in Mexico. *American Economic Journal: Economic Policy*, 6(4):71–99.
- Bosch, M. and Esteban-Pretel, J. (2013). The labor market effects of introducing unemployment benefits in an economy with high informality. Working Paper 402, IAD.
- Bruhn, M. and McKenzie, D. (2013). Using administrative data to evaluate municipal reforms: an evaluation of the impact of minas fácil expresso. *Journal of Development Effectiveness*, 5(3):319–338.
- Bruhn, M. and McKenzie, D. (2014). Entry regulation and the formalization of microenterprises in developing countries. *The World Bank Research Observer*, 29(2):186–201.
- Charmes, J. (2012). The informal economy worldwide: Trends and characteristics. *Marginal: The Journal of Applied Economic Research*, 6(2):103–132.
- Chetty, R., Looney, A., and Kroft, K. (2009). Salience and taxation: Theory and evidence. *American economic review*, 99(4):1145–77.
- De Mel, S., McKenzie, D., and Woodruff, C. (2013). The demand for, and consequences of, formalization among informal firms in sri lanka. *American Economic Journal: Applied Economics*, 5(2):122–50.

- Deaton, A. (1985). Panel data from time series of cross-sections. *Journal of Econometrics*, 30(1):109 – 126.
- Feltenstein, A. and Shamloo, M. (2013). Tax reform, the informal economy, and bank financing of capital formation. *International Tax and Public Finance*, 20(1):1–28.
- Fernandez, C. and Villar, L. (2017). The impact of lowering the payroll tax on informality in Colombia. *Economía*, 18(1):125–155.
- Fields, G. S. (1975). Rural-urban migration, urban unemployment and underemployment, and job-search activity in LDCs. *Journal of Development Economics*, 2(2):165 – 187.
- Garganta, S. and Gasparini, L. (2015). The impact of a social program on labor informality: The case of AUH in argentina. *Journal of Development Economics*, 115:99 – 110.
- Gorodnichenko, Y., Martinez-Vazquez, J., and Peter, K. S. (2009). Myth and reality of flat tax reform: Micro estimates of tax evasion response and welfare effects in Russia. *Journal of Political Economy*, 117(3):504–554.
- Henley, A., Arabsheibani, G. R., and Carneiro, F. G. (2009). On defining and measuring the informal sector: Evidence from Brazil. *World Development*, 37(5):992 – 1003.
- Jacquet, L., Lehmann, E., and der Linden, B. V. (2013). Optimal redistributive taxation with both extensive and intensive responses. *Journal of Economic Theory*, 148(5):1770 – 1805.
- Jäntti, M., Pirttilä, J., and Selin, H. (2015). Estimating labour supply elasticities based on cross-country micro data: A bridge between micro and macro elasticities? *Journal of Public Economics*. forthcoming.
- Kugler, A. and Kugler, M. (2009). Labor market effects of payroll taxes in developing countries: Evidence from Colombia. *Economic Development and Cultural Change*, 57(2):335–358.
- Kugler, A. D., Kugler, M. D., and Herrera-Prada, L. O. (2017). Do payroll tax breaks stimulate formality?: Evidence from colombia’s reform. *Economía*, 18(1):3–40.
- Lora, E. and Fajardo-González, J. (2016). Employment and taxes in Latin America: An empirical study of the effects of payroll, corporate income and value added taxes on labor outcomes. *Cuadernos de Economía*, 35(67):75–117.

- Maloney, W. F. (1999). Does informality imply segmentation in urban labor markets? evidence from sectoral transitions in Mexico. *The World Bank Economic Review*, 13(2):275–302.
- Maloney, W. F. (2004). Informality revisited. *World development*, 32(7):1159–1178.
- Matos, V. and Portela Souza, A. (2016). Mudanças dos diferenciais de salários formal e informal: redução da segmentação ou do salário hedônico? In Holanda Barbosa Filo, d. F., Ulyseu, G., and Veloso, F., editors, *Causas e Consequências da Informalidade No Brasil*, chapter 2. Elsevier.
- McKenzie, D. and Sakho, Y. S. (2010). Does it pay firms to register for taxes? the impact of formality on firm profitability. *Journal of Development Economics*, 91(1):15–24.
- Morales, L. and Medina, C. (2017). Assessing the effect of payroll taxes on formal employment: the case of the 2012 tax reform in Colombia. *Economía*, 18(1):75–124.
- Piketty, T. and Saez, E. (2013). Chapter 7 - optimal labor income taxation. In Auerbach, A. J., Chetty, R., Feldstein, M., and Saez, E., editors, *Handbook of Public Economics*, vol. 5, volume 5 of *Handbook of Public Economics*, pages 391 – 474. Elsevier.
- Tondini, A., Ardington, C., and Woolard, I. (2017). Public pensions and elderly informal employment: Evidence from a change in retirement age in South Africa. Working Paper 05, SALDRU.
- Zarković-Rakić, J., Randelović, S., and Vladislavljević, M. (2016). Labour market effects of social security contributions reform in Serbia. *Economic Annals*, LXI(208).

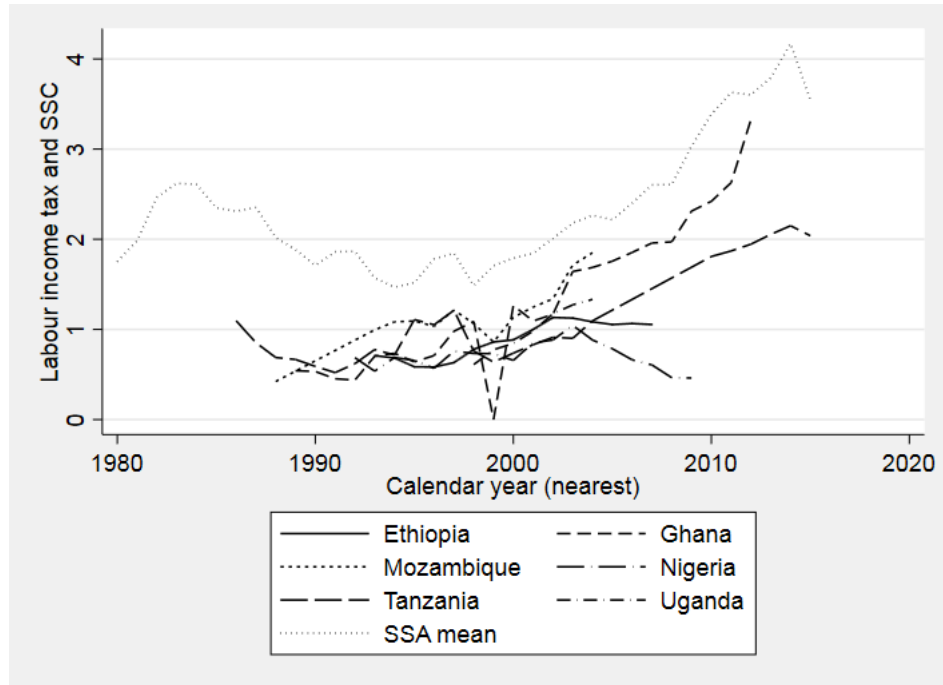


## Figures



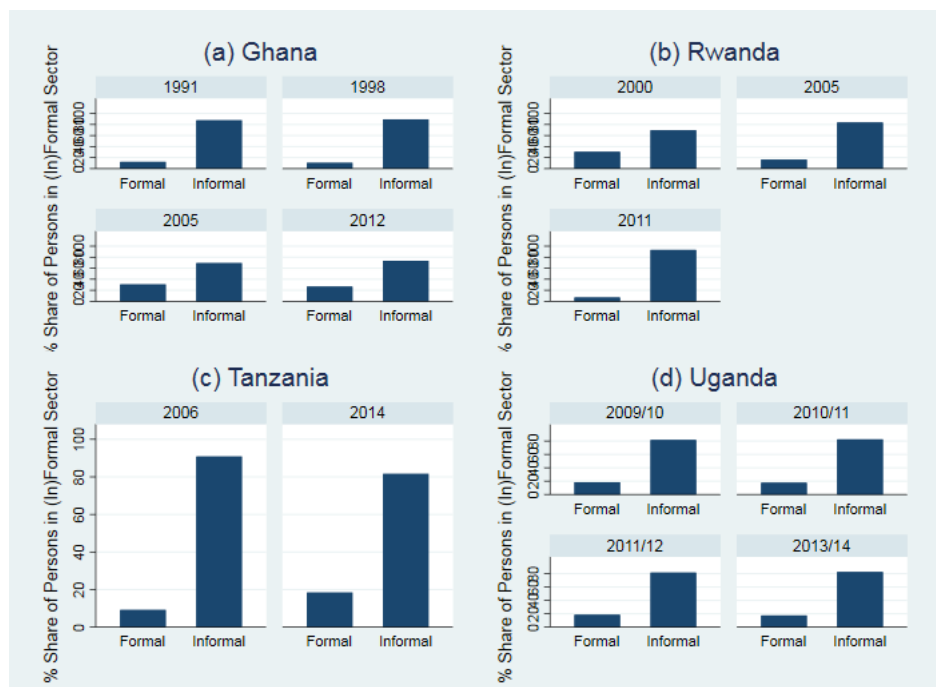
Source: Authors' own calculations based on UNU-WIDER-ICTD Government Revenue Dataset.

Figure 1: Tax revenues including social security contributions (SSC) as a percentage of GDP in selected African countries.



Source: Authors' own calculations based on UNU-WIDER-ICTD Government Revenue Dataset.

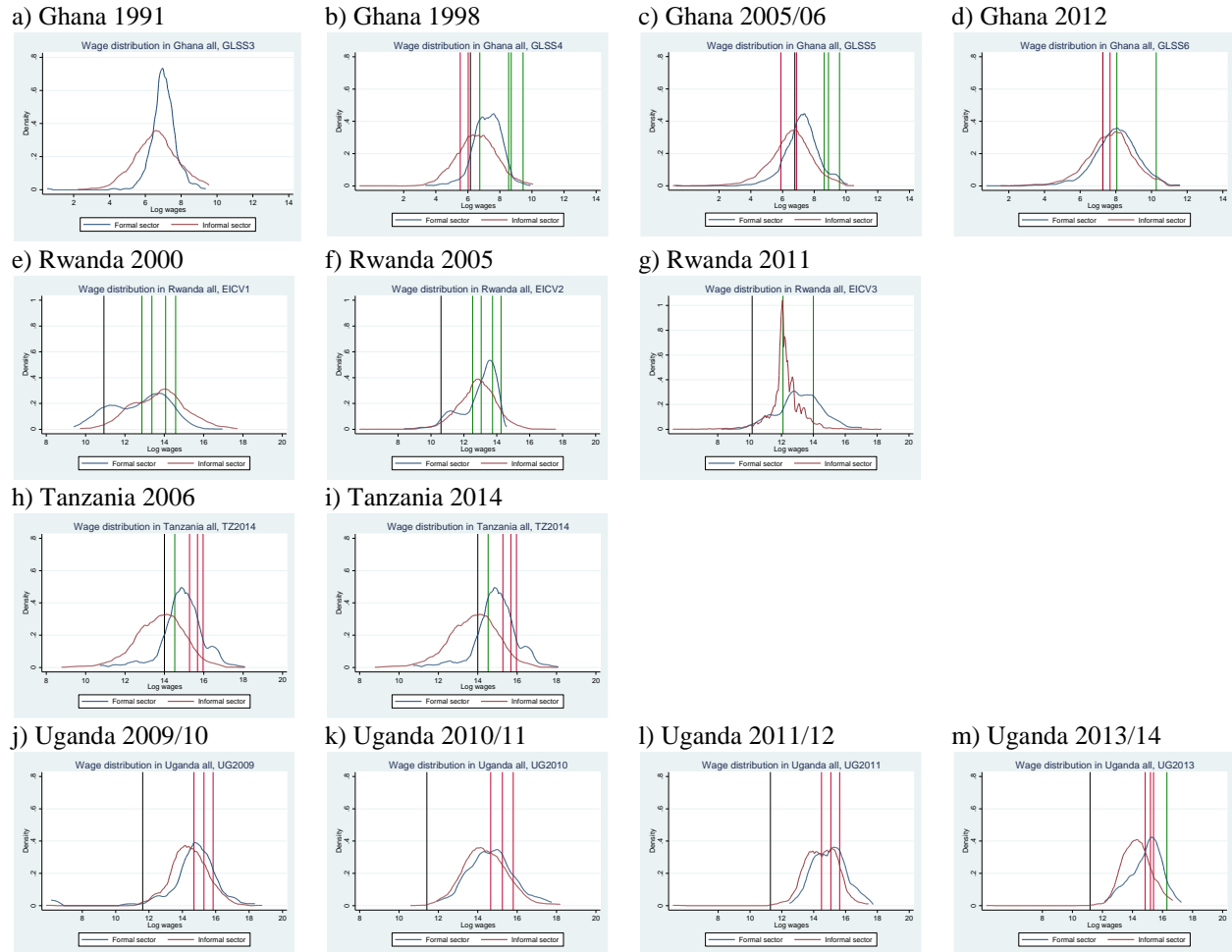
Figure 2: Labour income tax and social security contributions (SSC) receipts as a percentage of GDP in selected African countries.



Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

Figure 3: Share of Formal Workers by Country.

Figure 4: Distribution of aggregate Formal vs Informal Income by Country and Survey Wave



Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Note: The black vertical line indicates the minimum wage level and the red and green lines indicate the tax bracket kinks, whereby the green ones show some variation in tax rate over time whereas red ones do not.

Table 1: Summary Statistics by Country (as aggregate over survey waves)

	Ghana			Rwanda			Tanzania			Uganda		
	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total
Quasi-Public	0.00319 (0.0564)	0.0335 (0.180)	0.0118 (0.108)	0.0114 (0.106)	0.111 (0.314)	0.0215 (0.145)	0.0140 (0.118)	0.133 (0.340)	0.0327 (0.178)	0.0325 (0.177)	0.185 (0.389)	0.0599 (0.237)
Private Employee	0.245 (0.430)	0.495 (0.500)	0.315 (0.465)	0.193 (0.395)	0.499 (0.5)	0.224 (0.417)	0.203 (0.402)	0.584 (0.493)	0.262 (0.440)	0.501 (0.500)	0.697 (0.460)	0.536 (0.499)
Self Employed/Employer	0.675 (0.468)	0.412 (0.492)	0.601 (0.490)	0.0816 (0.274)	0.108 (0.31)	0.0842 (0.278)	0.551 (0.497)	0.227 (0.419)	0.500 (0.500)	0.00162 (0.0403)	0.00595 (0.0770)	0.00240 (0.0489)
Family Business/Home	0.0352 (0.184)	0.0383 (0.192)	0.0361 (0.186)	0.709 (0.454)	0.282 (0.45)	0.665 (0.472)	0.232 (0.422)	0.0547 (0.227)	0.204 (0.403)	0.465 (0.499)	0.112 (0.315)	0.402 (0.490)
Other Work	0.0416 (0.200)	0.0210 (0.143)	0.0358 (0.186)	0.00555 (0.0743)	0.000695 (0.0264)	0.00506 (0.071)	0.0000676 (0.00822)	0 (0)	0.0000571 (0.00755)	0 (0)	0 (0)	0 (0)
Armed Forces	0.00149 (0.0386)	0.0101 (0.0998)	0.00392 (0.0625)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.000501 (0.0224)	0.00368 (0.0606)	0.00107 (0.0327)
Legislator/Manager	0.0107 (0.103)	0.0277 (0.164)	0.0155 (0.124)	0.0119 (0.109)	0.142 (0.349)	0.0251 (0.156)	0.00235 (0.0484)	0.0277 (0.164)	0.00631 (0.0792)	0.00382 (0.0617)	0.0297 (0.170)	0.00846 (0.0916)
Professional	0.0173 (0.130)	0.0886 (0.284)	0.0375 (0.190)	0.00494 (0.0701)	0.0762 (0.265)	0.0122 (0.11)	0.00332 (0.0575)	0.0578 (0.233)	0.0118 (0.108)	0.0345 (0.183)	0.230 (0.421)	0.0695 (0.254)
Technician/Associate Professional	0.0170 (0.129)	0.0506 (0.219)	0.0265 (0.161)	0.00588 (0.0765)	0.0988 (0.298)	0.0153 (0.123)	0.0123 (0.110)	0.0549 (0.228)	0.0190 (0.136)	0.0652 (0.247)	0.195 (0.396)	0.0883 (0.284)
Clerk	0.00899 (0.0944)	0.0462 (0.210)	0.0195 (0.138)	0.104 (0.305)	0.0893 (0.285)	0.102 (0.303)	0.00511 (0.0713)	0.0603 (0.238)	0.0137 (0.116)	0.00774 (0.0876)	0.0424 (0.202)	0.0139 (0.117)
Service/Sales Workers	0.413 (0.492)	0.339 (0.473)	0.392 (0.488)	0.0889 (0.285)	0.243 (0.429)	0.105 (0.306)	0.279 (0.449)	0.283 (0.451)	0.280 (0.449)	0.166 (0.372)	0.0915 (0.289)	0.153 (0.360)
Agricultural Workers	0.0485 (0.215)	0.0183 (0.134)	0.0400 (0.196)	0.577 (0.494)	0.207 (0.405)	0.539 (0.498)	0.238 (0.426)	0.0837 (0.277)	0.213 (0.410)	0.0932 (0.291)	0.0429 (0.203)	0.0842 (0.278)
Craft/related Trades	0.284 (0.451)	0.191 (0.393)	0.257 (0.437)	0.0423 (0.201)	0.03 (0.171)	0.0411 (0.199)	0.175 (0.380)	0.129 (0.335)	0.168 (0.374)	0.0951 (0.293)	0.0829 (0.163)	0.0829 (0.276)
Plant/Machine Operators/Assemblers	0.0751 (0.264)	0.121 (0.326)	0.0880 (0.283)	0.0213 (0.145)	0.0305 (0.172)	0.0223 (0.148)	0.0432 (0.203)	0.180 (0.384)	0.0646 (0.246)	0.0340 (0.181)	0.0733 (0.261)	0.0410 (0.198)
Elementary Occupation	0.124 (0.330)	0.108 (0.310)	0.119 (0.324)	0.144 (0.351)	0.0832 (0.276)	0.138 (0.345)	0.242 (0.428)	0.124 (0.330)	0.223 (0.417)	0.500 (0.500)	0.265 (0.442)	0.458 (0.498)
Primary or Less	0.439 (0.496)	0.238 (0.426)	0.382 (0.486)	0.897 (0.304)	0.453 (0.498)	0.852 (0.355)	0.885 (0.319)	0.602 (0.490)	0.841 (0.366)	0.702 (0.458)	0.350 (0.477)	0.639 (0.480)
Lower Secondary	0.416 (0.493)	0.416 (0.493)	0.416 (0.493)	0.0239 (0.153)	0.0647 (0.246)	0.028 (0.165)	0.102 (0.302)	0.255 (0.436)	0.126 (0.332)	0.184 (0.387)	0.248 (0.433)	0.195 (0.397)
Upper Secondary	0.128 (0.335)	0.233 (0.423)	0.158 (0.365)	0.045 (0.207)	0.313 (0.464)	0.0722 (0.259)	0.0117 (0.107)	0.0831 (0.276)	0.0228 (0.149)	0.0459 (0.209)	0.0766 (0.266)	0.0514 (0.221)
Tertiary/Post-Secondary	0.0160 (0.126)	0.113 (0.316)	0.0434 (0.204)	0.00572 (0.0754)	0.131 (0.338)	0.0184 (0.135)	0.00178 (0.0421)	0.0596 (0.237)	0.0108 (0.103)	0.0685 (0.253)	0.326 (0.469)	0.114 (0.318)
Age 15-24	0.159 (0.366)	0.104 (0.306)	0.144 (0.351)	0.295 (0.456)	0.258 (0.438)	0.291 (0.454)	0.209 (0.407)	0.138 (0.345)	0.198 (0.398)	0.383 (0.486)	0.175 (0.380)	0.346 (0.476)
Age 25-34	0.346 (0.476)	0.347 (0.476)	0.346 (0.476)	0.326 (0.469)	0.361 (0.48)	0.329 (0.47)	0.351 (0.477)	0.367 (0.482)	0.353 (0.478)	0.317 (0.465)	0.408 (0.492)	0.333 (0.471)
Age 35-44	0.275 (0.447)	0.302 (0.459)	0.283 (0.450)	0.196 (0.397)	0.231 (0.422)	0.199 (0.4)	0.263 (0.440)	0.288 (0.453)	0.267 (0.443)	0.185 (0.388)	0.310 (0.463)	0.207 (0.405)
Age 45-54	0.168 (0.374)	0.188 (0.391)	0.174 (0.379)	0.137 (0.344)	0.124 (0.329)	0.136 (0.342)	0.130 (0.336)	0.169 (0.375)	0.136 (0.343)	0.0868 (0.282)	0.0835 (0.277)	0.0862 (0.281)
Age 55-60	0.0516 (0.221)	0.0586 (0.235)	0.0535 (0.225)	0.0466 (0.211)	0.0255 (0.158)	0.0445 (0.206)	0.0472 (0.212)	0.0386 (0.193)	0.0459 (0.209)	0.0289 (0.168)	0.0245 (0.155)	0.0281 (0.165)
Household Head	0.523 (0.499)	0.636 (0.481)	0.555 (0.497)	0.519 (0.5)	0.534 (0.499)	0.521 (0.5)	0.554 (0.497)	0.717 (0.451)	0.579 (0.494)	0.472 (0.499)	0.580 (0.494)	0.492 (0.500)
non-Household Head	0.477 (0.499)	0.364 (0.481)	0.445 (0.497)	0.481 (0.5)	0.466 (0.499)	0.479 (0.5)	0.446 (0.497)	0.283 (0.451)	0.421 (0.494)	0.528 (0.499)	0.420 (0.494)	0.508 (0.500)
Male	0.399 (0.490)	0.568 (0.495)	0.447 (0.497)	0.59 (0.492)	0.659 (0.474)	0.597 (0.491)	0.561 (0.496)	0.747 (0.435)	0.590 (0.492)	0.708 (0.455)	0.580 (0.494)	0.685 (0.465)
Female	0.601 (0.490)	0.432 (0.495)	0.553 (0.497)	0.41 (0.492)	0.341 (0.474)	0.403 (0.491)	0.439 (0.496)	0.253 (0.435)	0.410 (0.492)	0.292 (0.455)	0.420 (0.494)	0.315 (0.465)
Household size	4.588 (2.825)	4.246 (2.462)	4.491 (2.731)	5.294 (2.316)	6.056 (2.641)	5.371 (2.362)	4.826 (2.728)	4.711 (3.168)	4.808 (2.801)	6.491 (4.200)	5.968 (3.645)	6.397 (4.110)
Mean share of married individuals	0.524 (0.499)	0.579 (0.494)	0.540 (0.498)	0.394 (0.489)	0.427 (0.495)	0.397 (0.489)	0.259 (0.438)	0.254 (0.436)	0.259 (0.438)	0.416 (0.493)	0.481 (0.500)	0.428 (0.495)
Mean share of individuals with kids in hh	0.0124 (0.111)	0.00450 (0.0670)	0.0102 (0.101)	0.0515 (0.221)	0.0737 (0.261)	0.0538 (0.226)	0.0300 (0.171)	0.00331 (0.0574)	0.0259 (0.159)	0.0643 (0.245)	0.0100 (0.0998)	0.0546 (0.227)
Observations	21043			22819			19260			3003		

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Table 2: Decomposition of Mean Annual Income by Formality Status and Country (as aggregate over survey waves)

Mean Annual New Income	Ghana			Rwanda			Tanzania			Uganda		
	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total
all	3257.7 (5691.3)	4481.4 (7638.2)	3601.6 (6323.2)	536303.7 (1767232.1)	1033203.9 (2187826.1)	586595.0 (1820366.0)	3820186.8 (8550755.3)	4193190.2 (5478103.8)	3878511.2 (8148115.0)	3221518.8 (5424904.5)	5073075.7 (7473913.1)	3552123.7 (5885040.4)
rural	3532.0 (5347.0)	4603.9 (8139.1)	3945.9 (6587.0)	1159394.0 (2850160.7)	1285196.4 (2360002.5)	1188241.3 (2745832.5)	4628706.6 (9463277.2)	4540184.3 (5843781.0)	4611070.4 (8860812.0)	4054750.7 (6380375.4)	6225968.5 (8828286.9)	4552647.6 (7073255.4)
urban	3169.9 (5794.8)	4402.9 (7300.0)	3464.9 (6210.4)	377107.6 (1312023.6)	740118.0 (1928805.5)	399378.2 (1360655.0)	2658218.7 (6871361.9)	2875467.6 (3484296.8)	2676913.7 (6648015.8)	2700929.1 (4658032.7)	3791747.6 (5328415.4)	2857243.7 (4772994.8)
Employees	3432.0 (6115.5)	4330.2 (8143.6)	3610.1 (6576.8)	500322.2 (1776551.5)	1282684.3 (2853807.5)	541253.5 (1856607.9)	4244941.0 (9400332.3)	4737108.9 (6449596.1)	4275737.7 (9243950.2)	2337733.3 (3327311.8)	3187525.8 (5513546.7)	2381932.8 (3476988.9)
Self-Employed/Employer	2727.7 (4098.7)	4618.8 (7147.0)	3583.9 (5761.9)	676447.4 (1723531.3)	873635.9 (1605606.2)	726059.4 (1696651.2)	2285593.0 (3875412.7)	3979490.1 (5031081.7)	2929868.9 (4427994.7)	3996129.5 (6652480.2)	5325088.2 (7667623.3)	4347765.0 (6957933.3)
high-skilled occupations	4649.1 (7196.2)	7388.6 (12367.5)	6275.9 (10658.8)	1927820.2 (4559500.4)	1645105.0 (3061136.6)	1755184.0 (3717755.7)	8319792.0 (18208605.4)	8873330.1 (9120746.1)	8647016.2 (13584922.5)	5137078.3 (11647035.3)	7630184.6 (9829049.5)	6356651.8 (10856536.0)
semi-skilled occupations	3034.8 (4908.5)	3761.2 (5969.0)	3210.8 (5194.0)	1039008.8 (2896576.6)	1396612.4 (2840835.4)	1069109.3 (2893170.5)	4814144.7 (9385120.7)	4058603.0 (4623774.7)	4691217.3 (8791919.0)	4736168.0 (3947067.1)	4796215.7 (3548801.3)	4743884.6 (3892982.5)
low-skilled occupations	2778.4 (4856.2)	4033.0 (6512.1)	3132.0 (5403.6)	408690.5 (1283997.0)	785827.0 (1174596.7)	426179.1 (1281552.4)	2139841.3 (4754299.4)	2919324.1 (2889111.5)	2234068.0 (4576398.4)	2677365.9 (3775894.5)	2222681.2 (2512277.5)	2624194.1 (3653086.1)
services & sales occupations	3551.4 (6401.9)	3881.2 (5862.8)	3632.0 (6275.5)	418811.8 (1097801.6)	384489.0 (818781.2)	410725.6 (1038783.1)	6032495.8 (11370072.3)	3706627.3 (5081618.9)	5664689.6 (10659832.9)	3145342.6 (4968534.3)	4447420.3 (5251828.5)	3284955.2 (5010895.6)

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Note: All income figures are displayed in real local currency terms (based to 2010 values). As not all survey rounds for Ghana included a urban/rural indicator, the figures presented are for capital and non-capital region instead. The nine standardized occupational categories are aggregated as follows: high skilled: (1) Legislators, Managers and Senior Officials, (2) Professionals, (3) Technicians and Associate Professionals; semi-skilled: (4) Clerks, (7) Crafts and related trades workers; low - skilled: (6) skilled agricultural and fishery workers, (8) Machine operators and assemblers, (9) Elementary occupations; service and sales workers: (5) service and sales workers. The (0) armed forces category is here excluded.

Table 3 : Elasticity of Formal Work - detailed educational categories age 15-60

		disaggregated educational categories		aggregated educational categories	
		No controls (1)	All controls (2)	No controls (1)	All controls (2)
a) Ghana	Elasticity	0.324	-0.03	0.311	-0.029
	Std. Dev.	(0.217)	(0.1)	(0.225)	(0.106)
	Group N	130	130	110	110
b) Rwanda	Elasticity	-0.629***	0.342	-0.493**	0.482*
	Std. Dev.	(0.229)	(0.283)	(0.233)	(0.255)
	Group N	81	81	68	68
c) Tanzania	Elasticity	0.482***	-0.02	0.488***	-0.089
	Std. Dev.	(0.17)	(0.35)	(0.177)	(0.368)
	Group N	61	61	53	53
d) Uganda	Elasticity	0.218	-0.09	0.3	-0.103
	Std. Dev.	(0.219)	(0.104)	(0.218)	(0.096)
	Group N	74	74	78	78

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Column (1) presents the results of a model without controls. The next model (2) includes the full set of demographic characteristics and time dummies<sup>1</sup>. Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Table 4 : Elasticity of Formal Work – above minimum wage by gender age 15-60

		disaggregated educational categories			aggregated educational categories		
		All controls (1)	All controls (men) (2)	All controls (women) (3)	All controls (1)	All controls (men) (2)	All controls (women) (3)
a) Ghana	Elasticity	-0.041	-0.126	0.061	-0.042	-0.214	0.151
	Std. Dev.	(0.113)	(0.179)	(0.136)	(0.121)	(0.148)	(0.151)
	Group N	125	71	54	105	57	48
b) Rwanda	Elasticity	0.342	-0.194	0.670***	0.482*	0.031	0.685***
	Std. Dev.	(0.283)	(0.308)	(0.256)	(0.255)	(0.341)	(0.256)
	Group N	81	46	35	68	37	31
c) Tanzania	Elasticity	-0.02	-0.647**	-0.118	-0.089	-0.798**	-0.212
	Std. Dev.	(0.35)	(0.301)	(0.427)	(0.368)	(0.322)	(0.457)
	Group N	61	34	27	53	29	24
d) Uganda	Elasticity	-0.09	-0.071	-0.033	-0.103	-0.104	-0.07
	Std. Dev.	(0.104)	(0.122)	(0.196)	(0.096)	(0.105)	(0.187)
	Group N	74	45	29	78	46	32

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

All models include the full set of demographic characteristics and time dummies<sup>2</sup>. Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Table 5: Individual Level Regression validity test of group\*time interaction as first stage

	Ghana	Rwanda	Tanzania	Uganda
F-statistic	F(109, 18338) = 2.59	F( 68, 22222) = 4.86	F( 35, 19184) = 11.63	F(153, 2794) = 21.04
P-value	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Note: These estimates are based on a model with a full set of dummies with disaggregated educational categories and individuals aged 15-60

<sup>1</sup> These are year dummies, except for in Uganda where surveys are split over two years. In this case the year dummies are replaced by dummies for each wave.

<sup>2</sup> These are year dummies, except for in Uganda where surveys are split over two years. In this case the year dummies are replaced by dummies for each wave.

## Appendix

Table A.1: Summary Statistics – Ghana, by Survey Wave

	Ghana_GLSS3			Ghana_GLSS4			Ghana_GLSS5			Ghana_GLSS6		
	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total
Annual Net Income	1520.5 (2230.1)	1413.6 (1202.9)	1507.3 (2130.5)	1551.9 (2628.3)	1866.8 (1684.7)	1585.0 (2547.1)	1453.2 (2223.1)	2453.8 (3205.5)	1759.8 (2605.2)	4550.3 (6931.4)	6219.8 (9646.6)	4992.9 (7778.9)
Quasi-Public	0.00130 (0.0360)	0.265 (0.442)	0.0338 (0.181)	0.00496 (0.0703)	0.201 (0.401)	0.0256 (0.158)	0.00171 (0.0413)	0.0416 (0.200)	0.0139 (0.117)	0.00425 (0.0650)	0.0262 (0.160)	0.0101 (0.0998)
Private Employee	0.0805 (0.272)	0.677 (0.468)	0.154 (0.361)	0.100 (0.300)	0.721 (0.449)	0.165 (0.372)	0.247 (0.431)	0.475 (0.500)	0.317 (0.465)	0.244 (0.429)	0.512 (0.500)	0.315 (0.464)
Self Employed/Employer	0.910 (0.286)	0.0154 (0.123)	0.800 (0.400)	0.761 (0.426)	0.0783 (0.269)	0.689 (0.463)	0.740 (0.438)	0.472 (0.499)	0.658 (0.474)	0.629 (0.483)	0.360 (0.480)	0.557 (0.497)
Family Business/Home	0.000433 (0.0208)	0 (0)	0.000379 (0.0195)	0.131 (0.338)	0 (0)	0.117 (0.322)	0.00649 (0.0803)	0.00590 (0.0766)	0.00631 (0.0792)	0.0556 (0.229)	0.0668 (0.250)	0.0586 (0.235)
Other Work	0.00779 (0.0879)	0.0431 (0.203)	0.0121 (0.110)	0.00234 (0.0483)	0 (0)	0.00209 (0.0457)	0.00486 (0.0695)	0.00528 (0.0725)	0.00499 (0.0704)	0.0680 (0.252)	0.0347 (0.183)	0.0592 (0.236)
Armed Forces	0.00433 (0.0657)	0.0215 (0.145)	0.00645 (0.0801)	0.00253 (0.0502)	0.0345 (0.183)	0.00589 (0.0765)	0.00340 (0.0582)	0.0202 (0.141)	0.00856 (0.0921)	0.000129 (0.0113)	0.00112 (0.0334)	0.000391 (0.0198)
Legislator/Manager	0.0104 (0.101)	0.0831 (0.276)	0.0193 (0.138)	0.0157 (0.124)	0.111 (0.315)	0.0258 (0.159)	0.00253 (0.0503)	0.0176 (0.132)	0.00715 (0.0843)	0.0166 (0.128)	0.0364 (0.187)	0.0218 (0.146)
Professional	0.00173 (0.0416)	0.00308 (0.0555)	0.00190 (0.0435)	0.000877 (0.0296)	0.0294 (0.169)	0.00388 (0.0622)	0.0120 (0.109)	0.0679 (0.252)	0.0291 (0.168)	0.0212 (0.144)	0.107 (0.309)	0.0439 (0.205)
Technician/Associate Professional	0.00476 (0.0688)	0.191 (0.394)	0.0277 (0.164)	0.00405 (0.0635)	0.105 (0.307)	0.0147 (0.120)	0.0172 (0.130)	0.0540 (0.226)	0.0285 (0.166)	0.0168 (0.129)	0.0475 (0.213)	0.0250 (0.156)
Clerk	0.468 (0.499)	0.0646 (0.246)	0.418 (0.493)	0.435 (0.496)	0.0999 (0.300)	0.400 (0.490)	0.00807 (0.0895)	0.0371 (0.189)	0.0170 (0.129)	0.00885 (0.0937)	0.0542 (0.226)	0.0209 (0.143)
Service/Sales Workers	0.0407 (0.198)	0.0954 (0.294)	0.0474 (0.213)	0.0754 (0.264)	0.120 (0.325)	0.0801 (0.271)	0.317 (0.465)	0.290 (0.454)	0.309 (0.462)	0.483 (0.500)	0.383 (0.486)	0.456 (0.498)
Agricultural Workers	0.170 (0.376)	0.0585 (0.235)	0.156 (0.363)	0.128 (0.334)	0.0584 (0.235)	0.120 (0.325)	0.0548 (0.228)	0.0107 (0.103)	0.0413 (0.199)	0.0439 (0.205)	0.0250 (0.156)	0.0389 (0.193)
Craft/related Trades	0.178 (0.383)	0.0677 (0.252)	0.165 (0.371)	0.214 (0.410)	0.180 (0.385)	0.210 (0.407)	0.336 (0.473)	0.232 (0.422)	0.305 (0.460)	0.246 (0.431)	0.155 (0.362)	0.222 (0.415)
Plant/Machine Operators/Assemblers	0.0428 (0.203)	0.120 (0.325)	0.0524 (0.223)	0.0438 (0.205)	0.0925 (0.290)	0.0489 (0.216)	0.0634 (0.244)	0.122 (0.327)	0.0813 (0.273)	0.0836 (0.277)	0.120 (0.325)	0.0931 (0.291)
Elementary Occupation	0.0792 (0.270)	0.295 (0.457)	0.106 (0.308)	0.0812 (0.273)	0.169 (0.375)	0.0904 (0.287)	0.185 (0.388)	0.149 (0.356)	0.174 (0.379)	0.0806 (0.272)	0.0716 (0.258)	0.0782 (0.268)
Primary or Less	0.569 (0.495)	0.209 (0.407)	0.525 (0.499)	0.509 (0.500)	0.185 (0.389)	0.475 (0.499)	0.501 (0.500)	0.257 (0.437)	0.427 (0.495)	0.394 (0.489)	0.221 (0.415)	0.348 (0.477)
Lower Secondary	0.381 (0.486)	0.532 (0.500)	0.400 (0.490)	0.386 (0.487)	0.377 (0.485)	0.385 (0.487)	0.389 (0.488)	0.457 (0.498)	0.410 (0.492)	0.436 (0.496)	0.381 (0.486)	0.422 (0.494)
Upper Secondary	0.0428 (0.203)	0.209 (0.407)	0.0634 (0.244)	0.0972 (0.296)	0.345 (0.476)	0.123 (0.329)	0.0992 (0.299)	0.208 (0.406)	0.133 (0.339)	0.149 (0.357)	0.254 (0.435)	0.177 (0.382)
Tertiary/Post-Secondary	0.00692 (0.0829)	0.0492 (0.217)	0.0121 (0.110)	0.00734 (0.0854)	0.0925 (0.290)	0.0163 (0.127)	0.0106 (0.103)	0.0775 (0.267)	0.0311 (0.174)	0.0199 (0.140)	0.144 (0.351)	0.0528 (0.224)
Age 15-24	0.173 (0.378)	0.108 (0.310)	0.165 (0.371)	0.133 (0.340)	0.116 (0.321)	0.131 (0.338)	0.162 (0.369)	0.108 (0.310)	0.145 (0.353)	0.157 (0.364)	0.101 (0.302)	0.142 (0.349)
Age 25-34	0.351 (0.477)	0.375 (0.485)	0.354 (0.478)	0.373 (0.484)	0.315 (0.465)	0.367 (0.482)	0.342 (0.474)	0.348 (0.477)	0.344 (0.475)	0.348 (0.476)	0.346 (0.476)	0.348 (0.476)
Age 35-44	0.250 (0.433)	0.289 (0.454)	0.255 (0.436)	0.276 (0.447)	0.325 (0.469)	0.281 (0.450)	0.271 (0.445)	0.301 (0.459)	0.280 (0.449)	0.279 (0.448)	0.303 (0.460)	0.285 (0.451)
Age 45-54	0.162 (0.369)	0.182 (0.386)	0.165 (0.371)	0.153 (0.360)	0.199 (0.400)	0.158 (0.365)	0.175 (0.380)	0.188 (0.391)	0.179 (0.383)	0.164 (0.370)	0.188 (0.391)	0.170 (0.376)
Age 55-60	0.0640 (0.245)	0.0462 (0.210)	0.0618 (0.241)	0.0644 (0.245)	0.0455 (0.209)	0.0624 (0.242)	0.0505 (0.219)	0.0550 (0.228)	0.0519 (0.222)	0.0523 (0.223)	0.0618 (0.241)	0.0548 (0.228)
Household Head	0.197 (0.398)	0.138 (0.346)	0.190 (0.392)	0.523 (0.500)	0.827 (0.379)	0.555 (0.497)	0.524 (0.500)	0.652 (0.476)	0.563 (0.496)	0.523 (0.500)	0.622 (0.485)	0.549 (0.498)
non-Household Head	0.803 (0.398)	0.862 (0.346)	0.810 (0.392)	0.477 (0.500)	0.173 (0.379)	0.445 (0.497)	0.476 (0.500)	0.348 (0.476)	0.437 (0.496)	0.477 (0.500)	0.378 (0.485)	0.451 (0.498)
Male	0.327 (0.469)	0.822 (0.383)	0.388 (0.487)	0.356 (0.479)	0.804 (0.398)	0.403 (0.491)	0.374 (0.484)	0.557 (0.497)	0.430 (0.495)	0.417 (0.493)	0.577 (0.494)	0.460 (0.498)
Female	0.673 (0.469)	0.178 (0.383)	0.612 (0.487)	0.644 (0.479)	0.196 (0.398)	0.597 (0.491)	0.626 (0.484)	0.443 (0.497)	0.570 (0.495)	0.583 (0.493)	0.423 (0.494)	0.540 (0.498)
Household size	5.189 (3.026)	4.520 (2.930)	5.106 (3.022)	4.983 (2.647)	4.683 (2.583)	4.951 (2.642)	4.606 (2.825)	4.176 (2.455)	4.474 (2.724)	4.575 (2.825)	4.307 (2.466)	4.504 (2.737)
Observations	2636			3816			5027			9564		

Source: Authors' own estimations based on survey data from GLSS 3-6



Table A.2: Summary Statistics – Rwanda, by Survey Wave

	Rwanda_EICV1			Rwanda_EICV 2			Rwanda_EICV 3		
	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total
Annual Net Income	2167392.4 (4312098.5)	788215.9 (1448269.4)	1747326.2 (3737437.8)	674053.3 (1390648.2)	579826.7 (399001.7)	658604.7 (1282174.1)	392431.1 (1430492.6)	1383873.3 (2861954.5)	459597.7 (1588792.1)
Quasi-Public	0.0253 (0.157)	0.135 (0.343)	0.0588 (0.235)	0.0362 (0.187)	0.166 (0.372)	0.0574 (0.233)	0.00547 (0.0738)	0.0701 (0.255)	0.00985 (0.0988)
Private Employee	0.537 (0.499)	0.865 (0.343)	0.637 (0.481)	0.392 (0.488)	0.496 (0.500)	0.409 (0.492)	0.128 (0.335)	0.344 (0.475)	0.143 (0.350)
Self Employed/Employer	0.433 (0.496)	0 (0)	0.301 (0.459)	0.193 (0.395)	0.169 (0.375)	0.189 (0.392)	0.0341 (0.182)	0.120 (0.326)	0.0400 (0.196)
Family Business/Home	0.00427 (0.0653)	0 (0)	0.00297 (0.0544)	0.351 (0.477)	0.170 (0.376)	0.321 (0.467)	0.830 (0.375)	0.464 (0.499)	0.806 (0.396)
Other Work	0 (0)	0 (0)	0 (0)	0.0278 (0.164)	0 (0)	0.0232 (0.151)	0.00149 (0.0385)	0.00137 (0.0370)	0.00148 (0.0384)
Armed Forces	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Legislator/Manager	0.0152 (0.122)	0.119 (0.324)	0.0468 (0.211)	0.0227 (0.149)	0.139 (0.346)	0.0417 (0.200)	0.00955 (0.0972)	0.153 (0.360)	0.0193 (0.137)
Professional	0.00689 (0.0827)	0.0992 (0.299)	0.0350 (0.184)	0.0124 (0.110)	0.0654 (0.247)	0.0210 (0.144)	0.00331 (0.0574)	0.0723 (0.259)	0.00798 (0.0890)
Technician/Associate Professional	0.00723 (0.0847)	0.121 (0.326)	0.0418 (0.200)	0.00575 (0.0756)	0.104 (0.306)	0.0219 (0.146)	0.00581 (0.0760)	0.0865 (0.281)	0.0113 (0.106)
Clerk	0.335 (0.472)	0.0286 (0.167)	0.242 (0.428)	0.138 (0.345)	0.143 (0.351)	0.139 (0.346)	0.0806 (0.272)	0.0861 (0.281)	0.0810 (0.273)
Service/Sales Workers	0.234 (0.424)	0.358 (0.480)	0.272 (0.445)	0.156 (0.363)	0.248 (0.433)	0.171 (0.377)	0.0651 (0.247)	0.192 (0.394)	0.0737 (0.261)
Agricultural Workers	0.0931 (0.291)	0.106 (0.308)	0.0969 (0.296)	0.366 (0.482)	0.164 (0.371)	0.333 (0.471)	0.654 (0.476)	0.273 (0.446)	0.628 (0.483)
Craft/related Trades	0.0635 (0.244)	0.0282 (0.166)	0.0528 (0.224)	0.0538 (0.226)	0.0299 (0.170)	0.0499 (0.218)	0.0385 (0.192)	0.0308 (0.173)	0.0380 (0.191)
Plant/Machine Operators/Assemblers	0.0460 (0.210)	0.0449 (0.207)	0.0457 (0.209)	0.0395 (0.195)	0.0331 (0.179)	0.0384 (0.192)	0.0160 (0.125)	0.0229 (0.150)	0.0164 (0.127)
Elementary Occupation	0.199 (0.399)	0.0961 (0.295)	0.168 (0.374)	0.206 (0.404)	0.0720 (0.259)	0.184 (0.387)	0.127 (0.334)	0.0836 (0.277)	0.125 (0.330)
Primary or Less	0.724 (0.447)	0.474 (0.500)	0.647 (0.478)	0.740 (0.438)	0.452 (0.498)	0.693 (0.461)	0.941 (0.236)	0.445 (0.497)	0.907 (0.290)
Lower Secondary	0.101 (0.302)	0.152 (0.360)	0.117 (0.321)	0.0240 (0.153)	0.0340 (0.181)	0.0256 (0.158)	0.0183 (0.134)	0.0437 (0.205)	0.0201 (0.140)
Upper Secondary	0.0449 (0.207)	0.218 (0.414)	0.0977 (0.297)	0.0934 (0.291)	0.363 (0.481)	0.138 (0.345)	0.0353 (0.185)	0.327 (0.469)	0.0551 (0.228)
Tertiary/Post-Secondary	0.0826 (0.0621)	0.0913 (0.0558)	0.0852 (0.0213)	0.126 (0.0641)	0.151 (0.0937)	0.130 (0.0207)	0.143 (0.00554)	0.122 (0.184)	0.141 (0.0177)
Age 15-24	0.00621 (0.0786)	0.0558 (0.230)	0.0213 (0.145)	0.00641 (0.0798)	0.0937 (0.292)	0.0207 (0.142)	0.00554 (0.0742)	0.184 (0.388)	0.0177 (0.132)
Age 25-34	0.434 (0.496)	0.387 (0.487)	0.420 (0.494)	0.292 (0.455)	0.243 (0.429)	0.284 (0.451)	0.286 (0.452)	0.211 (0.408)	0.281 (0.449)
Age 35-44	0.300 (0.459)	0.335 (0.472)	0.311 (0.463)	0.331 (0.471)	0.333 (0.472)	0.331 (0.471)	0.326 (0.469)	0.388 (0.487)	0.330 (0.470)
Age 45-54	0.164 (0.371)	0.177 (0.382)	0.168 (0.374)	0.215 (0.411)	0.228 (0.420)	0.217 (0.412)	0.194 (0.396)	0.257 (0.437)	0.199 (0.399)
Age 55-60	0.0826 (0.275)	0.0913 (0.288)	0.0852 (0.279)	0.126 (0.332)	0.151 (0.359)	0.130 (0.337)	0.143 (0.350)	0.122 (0.328)	0.141 (0.349)
Household Head	0.0185 (0.135)	0.0101 (0.100)	0.0160 (0.125)	0.0357 (0.186)	0.0443 (0.206)	0.0371 (0.189)	0.0508 (0.220)	0.0220 (0.147)	0.0489 (0.216)
non-Household Head	0.432 (0.496)	0.422 (0.494)	0.429 (0.495)	0.670 (0.470)	0.589 (0.493)	0.657 (0.475)	0.495 (0.500)	0.553 (0.497)	0.499 (0.500)
Male	0.568 (0.496)	0.578 (0.494)	0.571 (0.495)	0.330 (0.470)	0.411 (0.493)	0.343 (0.475)	0.505 (0.500)	0.447 (0.497)	0.501 (0.500)
Female	0.627 (0.484)	0.611 (0.488)	0.622 (0.485)	0.793 (0.405)	0.681 (0.467)	0.775 (0.418)	0.546 (0.498)	0.668 (0.471)	0.555 (0.497)
Household size	0.373 (0.484)	0.389 (0.488)	0.378 (0.485)	0.207 (0.405)	0.319 (0.467)	0.225 (0.418)	0.454 (0.498)	0.332 (0.471)	0.445 (0.497)
Observations	5.986 (2.993)	6.095 (2.653)	6.019 (2.893)	5.483 (2.488)	6.298 (2.642)	5.617 (2.532)	5.207 (2.213)	5.908 (2.626)	5.254 (2.250)

Source: Authors' own estimations based on survey data from EICV 1-3

Table A.3: Summary Statistics – Tanzania, by Survey Wave

	Tanzania_2006			Tanzania_2014		
	Informal	Formal	Total	Informal	Formal	Total
Annual Net Income	7970667.3 (13632954.2)	4219696.9 (5557957.2)	7626953.6 (13146200.4)	1851450.7 (2756351.8)	4187563.4 (5461851.8)	2281174.2 (3536261.6)
Quasi-Public	0.0233 (0.151)	0.338 (0.473)	0.0522 (0.222)	0.00962 (0.0976)	0.0900 (0.286)	0.0244 (0.154)
Private Employee	0.273 (0.446)	0.586 (0.493)	0.302 (0.459)	0.169 (0.375)	0.584 (0.493)	0.246 (0.431)
Self Employed/Employer	0.680 (0.467)	0.0758 (0.265)	0.624 (0.484)	0.490 (0.500)	0.259 (0.438)	0.447 (0.497)
Family Business/Home	0.0236 (0.152)	0 (0)	0.0214 (0.145)	0.331 (0.471)	0.0664 (0.249)	0.282 (0.450)
Other Work	0.000210 (0.0145)	0 (0)	0.000191 (0.0138)	0 (0)	0 (0)	0 (0)
Armed Forces	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Legislator/Manager	0.00170 (0.0412)	0.0240 (0.153)	0.00375 (0.0611)	0.00265 (0.0514)	0.0285 (0.166)	0.00741 (0.0857)
Professional	0.00853 (0.0920)	0.0938 (0.292)	0.0163 (0.127)	0.000851 (0.0292)	0.0501 (0.218)	0.00991 (0.0991)
Technician/Associate Professional	0.0237 (0.152)	0.0917 (0.289)	0.0299 (0.170)	0.00695 (0.0831)	0.0471 (0.212)	0.0143 (0.119)
Clerk	0.00794 (0.0888)	0.0772 (0.267)	0.0143 (0.119)	0.00377 (0.0613)	0.0567 (0.231)	0.0135 (0.115)
Service/Sales Workers	0.466 (0.499)	0.269 (0.444)	0.448 (0.497)	0.191 (0.393)	0.286 (0.452)	0.208 (0.406)
Agricultural Workers	0.0348 (0.183)	0.0171 (0.130)	0.0332 (0.179)	0.334 (0.472)	0.0978 (0.297)	0.290 (0.454)
Craft/related Trades	0.223 (0.416)	0.162 (0.369)	0.217 (0.412)	0.153 (0.360)	0.122 (0.327)	0.147 (0.354)
Plant/Machine Operators/Assemblers	0.0514 (0.221)	0.134 (0.341)	0.0590 (0.236)	0.0394 (0.194)	0.189 (0.392)	0.0669 (0.250)
Elementary Occupation	0.183 (0.387)	0.131 (0.337)	0.179 (0.383)	0.269 (0.444)	0.123 (0.328)	0.243 (0.429)
Primary or Less	0.882 (0.323)	0.563 (0.496)	0.853 (0.355)	0.886 (0.318)	0.610 (0.488)	0.835 (0.371)
Lower Secondary	0.108 (0.310)	0.276 (0.447)	0.123 (0.329)	0.0989 (0.299)	0.251 (0.434)	0.127 (0.333)
Upper Secondary	0.00925 (0.0957)	0.132 (0.339)	0.0205 (0.142)	0.0128 (0.112)	0.0727 (0.260)	0.0238 (0.152)
Tertiary/Post-Secondary	0.00107 (0.0326)	0.0284 (0.166)	0.00357 (0.0597)	0.00212 (0.0460)	0.0662 (0.249)	0.0139 (0.117)
Age 15-24	0.237 (0.425)	0.0826 (0.275)	0.223 (0.416)	0.196 (0.397)	0.149 (0.356)	0.187 (0.390)
Age 25-34	0.388 (0.487)	0.335 (0.472)	0.383 (0.486)	0.333 (0.471)	0.374 (0.484)	0.341 (0.474)
Age 35-44	0.233 (0.423)	0.281 (0.450)	0.237 (0.425)	0.278 (0.448)	0.290 (0.454)	0.280 (0.449)
Age 45-54	0.105 (0.307)	0.230 (0.421)	0.117 (0.321)	0.141 (0.348)	0.156 (0.363)	0.144 (0.351)
Age 55-60	0.0377 (0.190)	0.0723 (0.259)	0.0409 (0.198)	0.0517 (0.221)	0.0314 (0.174)	0.0480 (0.214)
Household Head	0.554 (0.497)	0.771 (0.421)	0.574 (0.494)	0.554 (0.497)	0.705 (0.456)	0.582 (0.493)
non-Household Head	0.446 (0.497)	0.229 (0.421)	0.426 (0.494)	0.446 (0.497)	0.295 (0.456)	0.418 (0.493)
Male	0.604 (0.489)	0.759 (0.428)	0.619 (0.486)	0.540 (0.498)	0.745 (0.436)	0.578 (0.494)
Female	0.396 (0.489)	0.241 (0.428)	0.381 (0.486)	0.460 (0.498)	0.255 (0.436)	0.422 (0.494)
Household size	4.665 (2.654)	4.507 (2.421)	4.651 (2.634)	4.902 (2.759)	4.755 (3.304)	4.875 (2.867)
Observations	7383			11877		

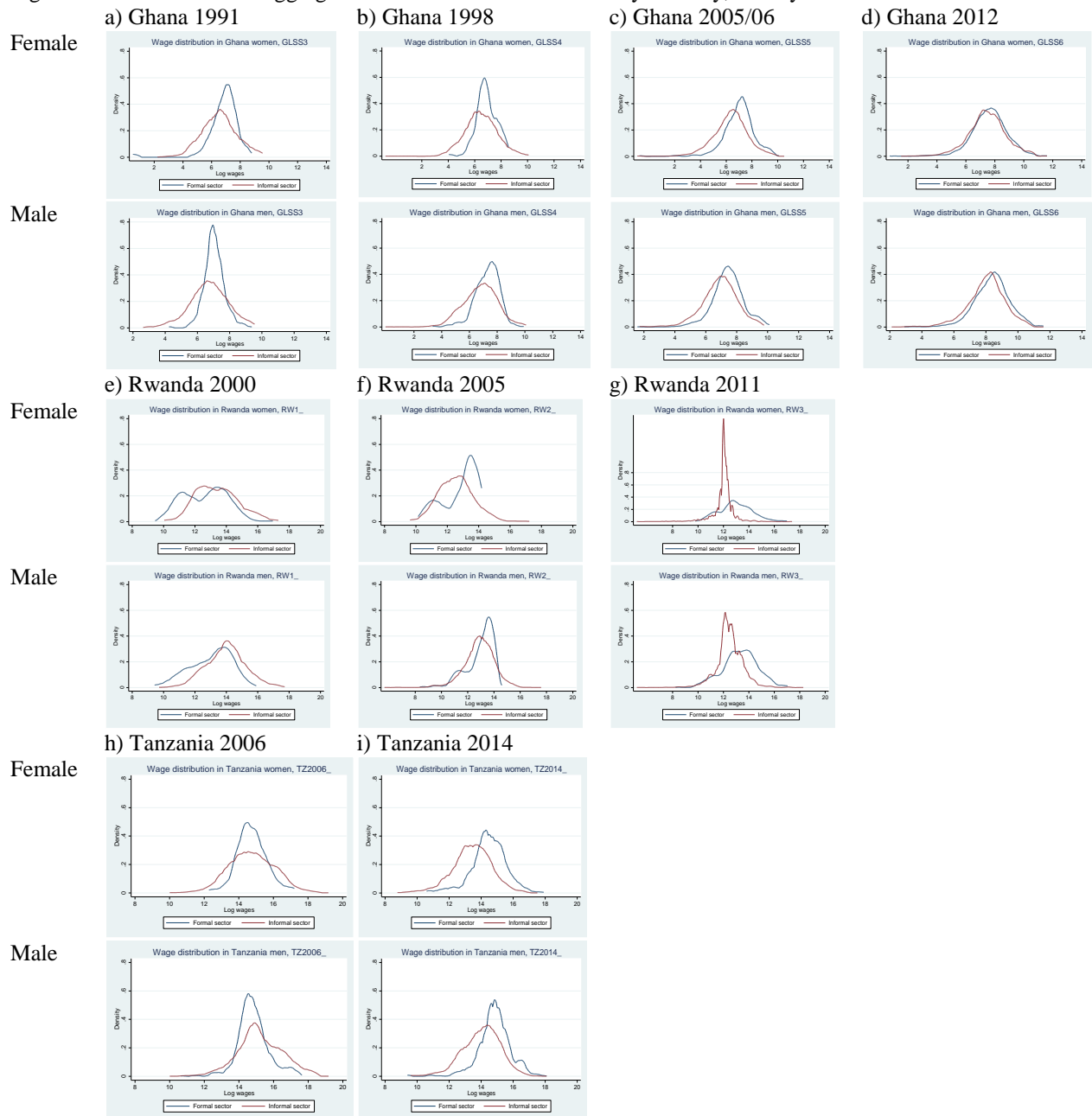
Source: Authors' own estimations based on survey data from IFLS 2006-2014

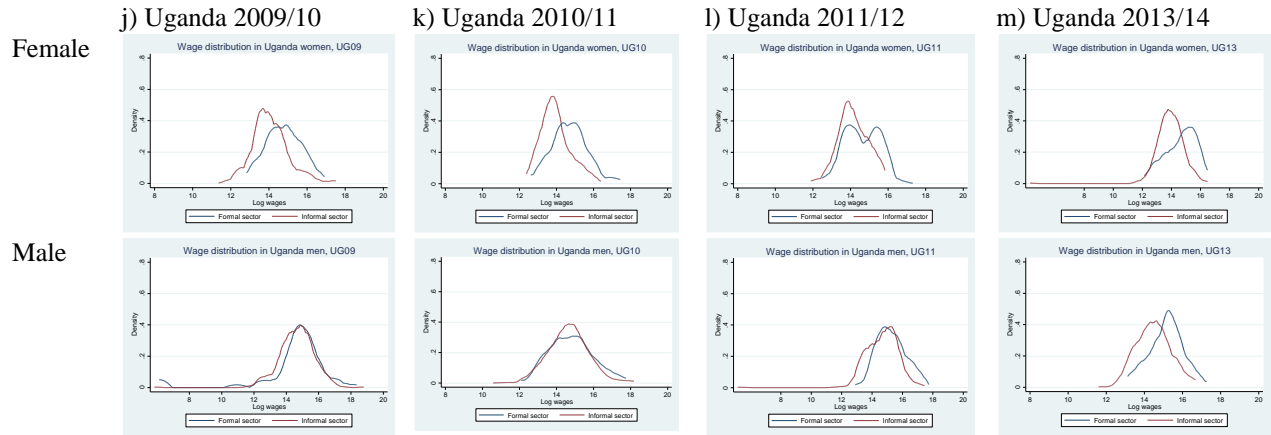
Table A.4: Summary Statistics – Uganda, by Survey Wave

	Uganda_NPL_2009/10			Uganda_NPL_2010/11			Uganda_NPL_2011/12			Uganda_NPL_2013/14		
	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal	Total
Annual Net Income	3558578.6 (7121874.0)	5544654.8 (1104733.1)	3924323.6 (8018143.1)	3655171.0 (7023130.7)	4728000.5 (7235529.3)	3842669.5 (7066692.2)	3303218.4 (4265411.5)	5443322.7 (6462386.7)	3697761.7 (4813614.6)	2580708.2 (2845697.8)	4770143.1 (4931527.8)	2962533.3 (3404860.7)
Quasi-Public	0.0206 (0.142)	0.173 (0.380)	0.0487 (0.215)	0.0320 (0.176)	0.163 (0.371)	0.0549 (0.228)	0.0409 (0.198)	0.172 (0.379)	0.0650 (0.247)	0.0341 (0.182)	0.224 (0.418)	0.0672 (0.251)
Private Employee	0.521 (0.500)	0.689 (0.465)	0.552 (0.498)	0.485 (0.500)	0.753 (0.433)	0.532 (0.499)	0.514 (0.500)	0.755 (0.432)	0.559 (0.497)	0.488 (0.500)	0.607 (0.490)	0.509 (0.500)
Self Employed/Employer	0.00790 (0.0886)	0.0280 (0.166)	0.0116 (0.107)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Family Business/Home	0.450 (0.498)	0.110 (0.314)	0.387 (0.488)	0.483 (0.500)	0.0839 (0.278)	0.413 (0.493)	0.445 (0.497)	0.0731 (0.261)	0.376 (0.485)	0.478 (0.500)	0.169 (0.376)	0.424 (0.495)
Other Work	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Armed Forces	0 (0)	0.0201 (0.141)	0.00371 (0.0608)	0.00176 (0.0420)	0 (0)	0.00146 (0.0382)	0.000261 (0.0162)	0.0459 (0.210)	0.00867 (0.0928)	0.0110 (0.104)	0.0459 (0.210)	0.0171 (0.130)
Legislator/Manager	0.0309 (0.173)	0.247 (0.433)	0.0706 (0.256)	0.00857 (0.0923)	0.117 (0.323)	0.0275 (0.164)	0.00113 (0.0337)	0.204 (0.405)	0.0385 (0.193)	0.0851 (0.279)	0.331 (0.472)	0.128 (0.334)
Professional Technician/Associate	0.0484 (0.215)	0.167 (0.374)	0.0703 (0.256)	0.0666 (0.249)	0.236 (0.427)	0.0962 (0.295)	0.122 (0.327)	0.281 (0.452)	0.151 (0.358)	0.0285 (0.167)	0.104 (0.307)	0.0417 (0.200)
Professional	0.00717 (0.0844)	0.0279 (0.165)	0.0110 (0.104)	0.00768 (0.0874)	0.0718 (0.259)	0.0189 (0.136)	0.00470 (0.0685)	0.00386 (0.0623)	0.00455 (0.0673)	0.0107 (0.103)	0.0637 (0.245)	0.0199 (0.140)
Clerk	0.169 (0.375)	0.0955 (0.295)	0.156 (0.363)	0.181 (0.385)	0.136 (0.345)	0.173 (0.378)	0.177 (0.382)	0.0627 (0.243)	0.156 (0.363)	0.144 (0.351)	0.0787 (0.270)	0.132 (0.339)
Service/Sales Workers	0.0949 (0.293)	0.0108 (0.104)	0.0794 (0.271)	0.111 (0.315)	0.121 (0.327)	0.113 (0.317)	0.0796 (0.271)	0.0304 (0.172)	0.0705 (0.256)	0.0892 (0.285)	0.0160 (0.126)	0.0764 (0.266)
Agricultural Workers	0.117 (0.321)	0.0314 (0.175)	0.101 (0.302)	0.107 (0.309)	0.0294 (0.170)	0.0933 (0.291)	0.0997 (0.300)	0.00790 (0.0889)	0.0827 (0.276)	0.0673 (0.251)	0.0393 (0.195)	0.0624 (0.242)
Craft/related Trades	0.0332 (0.179)	0.105 (0.308)	0.0464 (0.211)	0.0282 (0.166)	0.0333 (0.180)	0.0291 (0.168)	0.0402 (0.197)	0.129 (0.337)	0.0567 (0.231)	0.0338 (0.181)	0.0322 (0.177)	0.0335 (0.180)
Plant/Machine Operators/Assemblers	0.499 (0.500)	0.296 (0.458)	0.462 (0.499)	0.489 (0.500)	0.255 (0.438)	0.448 (0.498)	0.476 (0.500)	0.235 (0.426)	0.432 (0.496)	0.529 (0.499)	0.276 (0.449)	0.485 (0.500)
Elementary Occupation	0.733 (0.443)	0.419 (0.495)	0.675 (0.469)	0.734 (0.442)	0.398 (0.492)	0.675 (0.469)	0.662 (0.473)	0.255 (0.437)	0.587 (0.493)	0.689 (0.463)	0.345 (0.477)	0.629 (0.483)
Primary or Less	0.167 (0.373)	0.233 (0.424)	0.179 (0.384)	0.171 (0.376)	0.269 (0.445)	0.188 (0.391)	0.221 (0.415)	0.328 (0.471)	0.240 (0.428)	0.175 (0.380)	0.173 (0.380)	0.175 (0.380)
Lower Secondary	0.0360 (0.187)	0.0765 (0.267)	0.0435 (0.204)	0.0335 (0.180)	0.0678 (0.253)	0.0395 (0.195)	0.0575 (0.233)	0.0773 (0.268)	0.0612 (0.240)	0.0527 (0.224)	0.0828 (0.277)	0.0579 (0.234)
Upper Secondary	0.0635 (0.244)	0.272 (0.447)	0.102 (0.303)	0.0622 (0.242)	0.265 (0.443)	0.0976 (0.297)	0.0598 (0.237)	0.340 (0.476)	0.111 (0.315)	0.0840 (0.278)	0.399 (0.491)	0.139 (0.346)
Tertiary/Post-Secondary	0.354 (0.479)	0.0801 (0.273)	0.304 (0.460)	0.379 (0.485)	0.160 (0.368)	0.340 (0.474)	0.440 (0.497)	0.268 (0.445)	0.409 (0.492)	0.358 (0.480)	0.172 (0.378)	0.325 (0.469)
Age 15-24	0.335 (0.473)	0.383 (0.488)	0.344 (0.475)	0.329 (0.470)	0.423 (0.496)	0.345 (0.476)	0.290 (0.454)	0.382 (0.488)	0.307 (0.462)	0.316 (0.465)	0.437 (0.498)	0.337 (0.473)
Age 25-34	0.190 (0.392)	0.394 (0.491)	0.227 (0.419)	0.174 (0.380)	0.337 (0.475)	0.203 (0.402)	0.168 (0.374)	0.265 (0.443)	0.186 (0.389)	0.204 (0.403)	0.267 (0.444)	0.215 (0.411)
Age 35-44	0.0925 (0.290)	0.100 (0.302)	0.0940 (0.292)	0.0936 (0.291)	0.0654 (0.248)	0.0886 (0.284)	0.0677 (0.251)	0.0717 (0.259)	0.0684 (0.253)	0.0935 (0.291)	0.0962 (0.296)	0.0940 (0.292)
Age 45-54	0.0280 (0.165)	0.0429 (0.203)	0.0307 (0.173)	0.0249 (0.156)	0.0148 (0.121)	0.0231 (0.150)	0.0338 (0.181)	0.0138 (0.117)	0.0301 (0.171)	0.0287 (0.167)	0.0283 (0.166)	0.0286 (0.167)
Age 55-60	0.433 (0.496)	0.706 (0.457)	0.483 (0.500)	0.498 (0.500)	0.616 (0.489)	0.518 (0.500)	0.514 (0.500)	0.590 (0.494)	0.528 (0.500)	0.444 (0.497)	0.450 (0.499)	0.445 (0.497)
Household Head	0.567 (0.496)	0.294 (0.457)	0.517 (0.500)	0.502 (0.500)	0.384 (0.489)	0.482 (0.500)	0.486 (0.500)	0.410 (0.494)	0.472 (0.500)	0.556 (0.497)	0.550 (0.499)	0.555 (0.497)
non-HHhead	0.696 (0.460)	0.653 (0.478)	0.688 (0.464)	0.715 (0.452)	0.511 (0.502)	0.679 (0.467)	0.702 (0.458)	0.612 (0.489)	0.686 (0.465)	0.715 (0.452)	0.553 (0.499)	0.687 (0.464)
Male	0.304 (0.460)	0.347 (0.478)	0.312 (0.464)	0.285 (0.452)	0.489 (0.502)	0.321 (0.467)	0.298 (0.458)	0.388 (0.489)	0.314 (0.465)	0.285 (0.452)	0.447 (0.499)	0.313 (0.464)
Female	7.022 (5.167)	6.236 (3.544)	6.877 (4.916)	6.552 (3.819)	5.434 (3.457)	6.356 (3.780)	6.311 (4.371)	6.106 (4.405)	6.274 (4.374)	6.233 (3.534)	6.075 (3.065)	6.205 (3.455)
Household size	719	697	688	719	697	688	719	697	688	719	697	688
Observations	719	697	688	719	697	688	719	697	688	719	697	688

Source: Authors' own estimations based on survey data from NPL 2009/2010 – 2013/2014

Figure A.1: Distribution of aggregate Formal vs Informal Income by Country, Survey Wave and Gender





Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Table A.5: Elasticity of Formal Work – Age Categories 25-60 and >15

		Age 25-60				Age >15			
		Disaggregated educ. categories		Aggregate educ. categories		Disaggregated educ. categories		Aggregate educ. categories	
		No controls (1)	All controls (2)	No controls (1)	All controls (2)	No controls (1)	All controls (2)	No controls (1)	All controls (2)
a)	Elasticity	0.229	-0.013	0.191	-0.017	0.032	-0.016	0.009	-0.011
Ghana	Std. Dev.	(0.251)	(0.108)	(0.272)	(0.119)	(0.171)	(0.059)	(0.171)	(0.059)
	Group N	105	105	87	87	148	148	128	128
b)	Elasticity	-1.280***	-0.06	-1.074***	0.147	-0.646***	0.378	-0.508**	0.521**
Rwanda	Std. Dev.	(0.248)	(0.261)	(0.23)	(0.255)	(0.234)	(0.285)	(0.237)	(0.257)
	Group N	65	65	53	53	85	85	72	72
c)	Elasticity	0.439**	0.034	0.443**	-0.068	0.474***	0.03	0.483***	-0.029
Tanzania	Std. Dev.	(0.186)	(0.443)	(0.192)	(0.497)	(0.161)	(0.335)	(0.168)	(0.348)
	Group N	51	51	43	43	69	69	60	60
d)	Elasticity	-0.074	-0.111	0.01	-0.119*	0.23	-0.085	0.308	-0.098
Uganda	Std. Dev.	(0.173)	(0.08)	(0.194)	(0.072)	(0.217)	(0.107)	(0.216)	(0.099)
	Group N	54	54	55	55	76	76	80	80

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Models (1) have no controls and models (2) control for the full set of demographic characteristics and time dummies<sup>3</sup>. Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014

Table A.6 : Elasticity of Formal Work – Heterogeneity Analysis of Different Age Categories (15-60 and >15)

		Age 25-60 (all controls)						Age >15 (all controls)					
		disaggregated educ. categories			aggregate educ. categories			disaggregated educ. categories			aggregate educ. categories		
		All (3)	men (4)	women (5)	All (3)	men (4)	women (5)	All (3)	men (4)	women (5)	All (3)	men (4)	women (5)
a)	Elasticity	-0.033	-0.072	0.08	-0.038	-0.195	0.184	-0.017	-0.197	0.066	-0.011	-0.263**	0.097
Ghana	Std. Dev.	(0.119)	(0.198)	(0.133)	(0.131)	(0.152)	(0.152)	(0.076)	(0.161)	(0.064)	(0.077)	(0.131)	(0.061)
	Group N	103	58	45	85	45	40	141	82	59	122	68	54
b)	Elasticity	-0.06	-0.203	0.136	0.147	0.138	0.123	0.378	-0.113	0.687***	0.521**	0.128	0.702***
Rwanda	Std. Dev.	(0.261)	(0.396)	(0.31)	(0.25)5	(0.449)	(0.276)	(0.285)	(0.312)	(0.263)	(0.257)	(0.34)	(0.263)
	Group N	65	38	25	53	30	23	85	50	35	72	41	31
c)	Elasticity	0.034	-0.731*	0.277	-0.068	-0.964**	0.219	-0.032	-0.657**	-0.119	-0.102	-0.807**	-0.213
Tanzania	Std. Dev.	(0.443)	(0.393)	(0.361)	(0.497)	(0.406)	(0.465)	(0.357)	(0.312)	(0.438)	(0.375)	(0.331)	(0.47)
	Group N	51	29	22	43	24	19	68	40	28	59	34	25
d)	Elasticity	-0.111	-0.112	0.04	-0.119*	-0.154	0.055	-0.085	-0.062	-0.033	-0.098	-0.096	-0.07
Uganda	Std. Dev.	(0.08)	(0.133)	(0.08)	(0.072)	(0.105)	(0.093)	(0.107)	(0.122)	(0.197)	(0.099)	(0.106)	(0.188)
	Group N	54	35	19	55	35	20	76	47	29	80	48	32

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

All models include the full set of demographic characteristics and time dummies<sup>4</sup> and are restricted to individuals with above minimum wage income. Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

<sup>3</sup> These are year dummies, except for in Uganda where surveys are split over two years. In this case the year dummies are replaced by dummies for each wave.

<sup>4</sup> These are year dummies, except for in Uganda where surveys are split over two years. In this case the year dummies are replaced by dummies for each wave.

Table A.7 : Elasticity of Formal Work - detailed educational categories age 15-60 (only employees)

		above minimum wage				
		No controls (1)	All controls (2)	All controls (3)	All controls (men) (4)	All controls (women) (5)
a) Ghana	Elasticity	0.343***	0.023	0.026	0.05	-0.018
	Std. Dev.	(0.11)	(0.036)	(0.039)	(0.049)	(0.08)
	Group N	93	93	88	57	31
b) Rwanda	Elasticity	0.045	-0.389**	-0.389**	-0.166	-0.830***
	Std. Dev.	(0.17)	(0.171)	(0.171)	(0.218)	(0.256)
	Group N	60	60	60	35	25
c) Tanzania	Elasticity	0.504*	0.152	0.152	-0.035	-0.082
	Std. Dev.	(0.258)	(0.185)	(0.185)	(0.467)	(0.156)
	Group N	50	50	50	27	23
d) Uganda	Elasticity	0.163	-0.112	-0.112	-0.103	-0.239
	Std. Dev.	((0.171)	(0.098)	(0.098)	(0.116)	(0.151)
	Group N	62	62	62	40	21

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

Table A.8 : Elasticity of Formal Work – Alternative 2 with aggregate educational categories, age, occupation and urbanity status (aged 15-60 )

		above minimum wage				
		No controls (1)	All controls (2)	All controls (3)	All controls (men) (4)	All controls (women) (5)
a) Ghana	Elasticity	0.184	-0.043	-0.05	-0.046	0.002
	Std. Dev.	(0.13)	(0.074)	(0.102)	(0.13)	(0.132)
	Group N	278	278	246	145	101
b) Rwanda	Elasticity	-0.301	0.362	0.362	0.159	0.77
	Std. Dev.	(0.291)	(0.27)	(0.27)	(0.256)	(0.996)
	Group N	154	154	154	96	55
c) Tanzania	Elasticity	0.545***	-0.074	-0.138	-0.303	-0.107
	Std. Dev.	(0.15)	(0.215)	(0.28)	(0.268)	(0.36)
	Group N	139	138	138	82	54
d) Uganda	Elasticity	-0.002	-0.045	-0.045	-0.071	0.391
	Std. Dev.	(0.341)	(0.119)	(0.119)	(0.103)	(0.622)
	Group N	42	42	42	27	15

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Group N indicates the number of grouped observations.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

Table A.9 : Elasticity of Formal Work – Alternative 3 with aggregate age, occupation and urbanity status with additional controls (aged 15-60 )

		above minimum wage				
		No controls (1)	All controls (2)	All controls (3)	All controls (men) (4)	All controls (women) (5)
a) Ghana	Elasticity	0.654***	0.06	0.061	0.131	-0.013
	Std. Dev.	(0.188)	(0.1)	(0.159)	(0.241)	(0.175)
	Group N	202	202	178	112	66
b) Rwanda	Elasticity	-0.695***	-0.009	-0.009	-0.207	0.972
	Std. Dev.	(0.226)	(0.221)	(0.221)	(0.233)	(0.716)
	Group N	146	146	145	90	55
c) Tanzania	Elasticity	0.473***	0.05	0.046	0.052	-0.321
	Std. Dev.	(0.151)	(0.235)	(0.239)	(0.31)	(0.426)
	Group N	118	112	112	67	45
d) Uganda	Elasticity	0.25	-0.09	-0.09	-0.061	-0.331
	Std. Dev.	(0.239)	(0.122)	(0.122)	(0.121)	(0.394)
	Group N	88	88	88	57	31

Note: Robust standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Group N indicates the number of grouped observations. Additional controls are the share of married individuals and the share of individuals with children in the households, the share of employees/self-employed individuals and the share of household heads in the respective group.

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

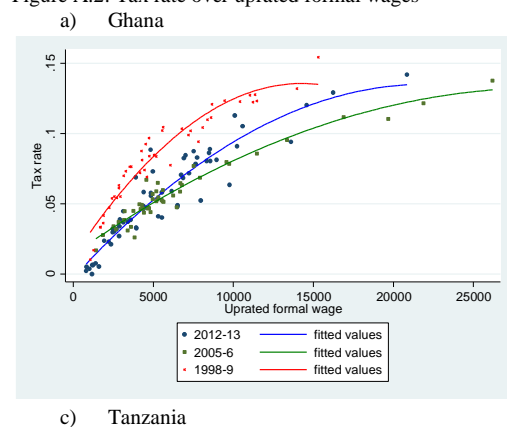
Table A.10 : Determinants of Formal /Informal Sector Employment Choice (aged 15-60 )

VARIABLES	Ghana formal	Rwanda formal	Tanzania formal	Uganda formal
2.survey round	-0.381*** (0.0382)	-0.430*** (0.0506)	0.508*** (0.0255)	-0.0445 (0.0725)
3.survey round	0.0994*** (0.0372)	-0.723*** (0.0452)	-0.196*** (0.0271)	-0.0391 (0.0727)
4.survey round	-0.204*** (0.0365)	-0.235*** (0.0325)		-0.115* (0.0697)
2.sex	-0.263*** (0.0261)			0.187*** (0.0610)
1.urban	0.0802*** (0.0256)	0.160*** (0.0351)	0.148*** (0.0326)	0.163*** (0.0549)
2.educ2	0.325*** (0.0258)	0.622*** (0.0570)	0.744*** (0.0278)	0.532*** (0.0703)
3.educ2	0.640*** (0.0332)	1.210*** (0.0410)	1.179*** (0.0564)	0.567*** (0.113)
4.educ2	1.464*** (0.0508)	1.650*** (0.0755)	1.313*** (0.0944)	0.878*** (0.0898)
wage	7.53e-06*** (1.87e-06)	1.52e-08** (7.55e-09)	1.59e-08*** (2.67e-09)	2.62e-08*** (9.03e-09)
2.comp_occup_cat	-1.281*** (0.0364)	-1.186*** (0.0554)	-1.255*** (0.0497)	-1.021*** (0.0966)
3.comp_occup_cat	-0.885*** (0.0384)	-0.119** (0.0537)	-1.123*** (0.0465)	-0.815*** (0.0897)
4.comp_occup_cat	-1.009*** (0.0387)	-1.196*** (0.0468)	-1.287*** (0.0488)	-1.004*** (0.0786)
2.age_group	0.253*** (0.0364)	0.0681* (0.0412)	0.315*** (0.0394)	0.446*** (0.0776)
3.age_group	0.436*** (0.0413)	-0.00242 (0.0528)	0.593*** (0.0473)	0.545*** (0.0936)
1.married	0.164*** (0.0225)	0.259*** (0.0307)	-0.159*** (0.0308)	0.112** (0.0548)
1.kids	-0.0612 (0.124)	0.207*** (0.0645)	-0.688*** (0.138)	0.109 (0.165)
1.hhhead	0.0828*** (0.0260)	0.0811** (0.0361)	0.202*** (0.0286)	0.119* (0.0630)
1.employee	0.413*** (0.0257)	0.0616* (0.0369)	0.956*** (0.0261)	-0.266*** (0.0547)
Constant	-0.268*** (0.0572)	-0.217*** (0.0690)	-1.104*** (0.0650)	-0.816*** (0.120)
Observations	21,358	23,308	21,227	3,826

Robust standard errors in parentheses \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Source: Authors' own estimations based on survey data from GLSS 3-6, EICV 1-3, IFLS 2006-2014 and NPL 2009/2010 – 2013/2014.

Figure A.2: Tax rate over uprated formal wages



Source: Authors' own estimations based on survey data from GLSS 3-6

Note: Give the real income growth between the survey rounds the income in the earlier survey rounds has been uprated by the men income growth rate between those years. The first round for Ghana GLSS3 is excluded here as no precise tax rate information is available for those years.